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The Dependence of America

AT THE RECENT MEETING of the U. S. Chamber of Commerce in Washington two addresses were delivered that stressed the economic dependency of the United States on the rest of the world—aiming to correct the popular impression that the United States is or could easily be self-sufficient, and surrounded by a Chinese economic wall. The first of these speeches was by Dr. Julius Klein, Director of the Bureau of Foreign and Domestic Commerce: the second by the Hon. William C. Redfield, former Secretary of Commerce. The speech of the latter was indeed only a brief keynote of a fascinating and instructive book which he has just published, on "Dependent America," in which in patient detail he shows American dependence, in every department of life and for every minute of the day, upon the products of foreign climates, labor, and trade. Doctor Klein stressed our dependence on imported raw materials, dwelling especially on the much-advertised case of rubber.

This condition of economic dependence of the United States it shares, of course, with all other countries; and the more advanced a country is, and consequently the more complex its material civilization, the more its life is interwoven with the web of all the world, north and south, east and west. The international features of the mineral industry have been stressed repeatedly in these pages, and by the chief editor recently in an issue of *Foreign Affairs:* the conditions as analyzed correspond with those pointed out by the distinguished speakers at the Chamber of Commerce.

It is to be feared, indeed, that Senator Cameron, of Arizona, who recently took up considerable space in the Senate records with the charge that the *Engineering and Mining Journal* was international in its thought and scope, would be obliged to prefer the same charge against these gentlemen. Concerning nationalism Mr. Redfield writes: "Though it is true that the influence of nationalism has led to permanent good, it is also true that in its extreme form it has left deep scars on all the world's history. Its good, though great, is of limited scope; its evils at their worst know almost no boundaries. Nationalism survives chiefly in the fields of economics and politics, but its supremacy is threatened in both, and in the economic sphere finance as well as science are its powerful foes. Its survival in politics is due in major part to ignorance, the fruitful cause of misunderstanding."

More Interest in Copper Economics

THE ORGANIZATION of a new association of copper exporters has aroused more interest in the last month than at any time since the news first leaked out last winter. The new association was expected to be ready to function by the first of July, but now it seems desirable that the Federal Trade Commission give its informal approval, and that commission apparently is taking a vacation for the summer. Senator Cameron has achieved considerable publicity for his views in the matter; he is apparently trying to attract attention to himself as a friend of the Arizona miners and voters; he has taken up the cudgels for a copper tariff, and sees no good in any organization such as that proposed for the export association, which he fears will inure to the disadvantage of the American producer. Some of the metropolitan newspapers have taken up the matter editorially, for instance *The Journal of Commerce* and *The World;* they are inclined to ask Mr. Hoover what he thinks of the scheme. Mr. Hoover has been active in criticising foreign monopolies of rubber and other products, and they wonder what his position will be when the monopoly is dominated by an American group. However, the rubber and copper situations do not appear on the surface to be the same. So far as any semi-official announcements have gone, there is no thought of any control of production; each member company is entirely free to make as much copper as it desires, and, with regard to United States companies, to sell as freely in the domestic market as ever. Furthermore, there seems to be no desire to make any such limiting price agreement, as is done for some other restricted commodities.

It is logical, of course, to expect that any organization under the Webb-Pomerene Law must indirectly have some effect on the domestic market, even though control of domestic prices and production is explicitly forbidden. Sellers and buyers of metals watch the London quotations much more closely than they did before the World War, and much strength and weakness of the domestic market is a reflection of conditions abroad. Most of the metals enjoy a world market, with quotations in one country on a parity with those in another, due consideration of course being given to freight rates and tariff walls.

Potash Prospecting in the United States

REALIZING that the United States is at present dependent upon foreign countries for its supply of potash, the last session of Congress appropriated $100,000 per year for five years "for the purpose of determining the location, extent, and mode of occurrence of potash deposits in the United States and conducting the necessary laboratory tests incident thereto." The act authorizes the Secretary of the Interior and the Secretary of Commerce, jointly, to enter into co-operative agreements "with individuals, associations, corporations, states, or other bodies" to carry on a prospecting campaign. Before drilling begins the Secretaries and their co-operators shall enter into a contract with owners or lessees of lands or mineral rights within a radius of not less than one mile from the proposed wells, whereby the owners or lessees "shall pay to the government and its co-operators an amount equal to the

actual cost of said explorations"; owners or lessees of land or mineral rights agree that "incident to any discovery of potash" the Secretaries shall act as referee to determine the "maximum price at which potash rights in such lands shall be sold," in order to forestall profiteering; and they also agree that the Secretaries may establish an equitable market price for such potash as may be produced from said land.

The question of securing pre-drilling contracts with owners or lessees within the prescribed area to comply with the above specifications, especially to reimburse the government and its co-operators, will not meet with favor among ranchers and others who may be owners of mineral rights or lands. They will be slow to enter into a contract wherein they subject themselves to assessments to reimburse corporations and individuals whose main object is to exploit the potash deposits.

The act is not specific as to whether reimbursement is contingent upon discovery of potash or not. It may be proper to reimburse the government in the event of discovery, since the money spent is appropriated from the public funds. To reimburse the co-operators is a far different question. The co-operator who may be an owner or lessee of part of the ground within the prescribed area enters into the prospecting program for profit and puts up his money for no other purpose. Under the act he is to be reimbursed, presumably, in proportion to his holdings. The enabling act is as follows:

"There is hereby authorized to be appropriated, out of any moneys in the Treasury not otherwise appropriated, the sum of $100,000 for the fiscal year ending June 30, 1927, and a similar amount for each succeeding fiscal year for four years, to be expended as may be mutually agreed upon by the Secretary of the Interior and the Secretary of Commerce for the purpose of determining the location, extent, and mode of occurrence of potash deposits in the United States and conducting the necessary laboratory tests incident thereto.

"Sec. 2. The Secretary of the Interior and the Secretary of Commerce jointly are hereby authorized, within their discretion, to co-operate under formal agreement with individuals, associations, corporations, states, municipalities, educational institutions, or other bodies, for the purposes of this act: *Provided*, That before undertaking drilling operations upon any tract or tracts of land the Secretary of the Interior and the Secretary of Commerce, jointly, shall enter into a contract or contracts with the owners or lessees, or both, of the mineral rights therein, which contract shall provide, among other things, that not more than the actual cost of the exploration shall constitute a preferred claim in favor of the United States and its co-operators against any minerals developed; and the aforesaid contract or contracts shall provide that the owners or lessees, or both, of said lands and/or mineral rights within the radius hereinafter mentioned, shall pay to the government and its co-operators an amount equal to the actual costs of said explorations, said payments to be made at such time or times, in such manner, and in such proportions as said Secretaries may, in their discretion, determine to be equitable: *Provided further*, That such contract shall not restrict the Secretary of the Interior and the Secretary of Commerce jointly in the choice of drilling locations within the property or in the conduct of the exploratory operations, so long as such selections or conduct do not interfere unreasonably with the use of the surface of the land or with the improvements thereon, and such contract shall provide that the United States and its co-operators shall not be liable for damages on account of such reasonable use of the surface as may be necessary in the proper conduct of the work: *Provided further*, That before such drilling be commenced the Secretary of the Interior and the Secretary of Commerce jointly shall require the owners of land and/or mineral rights therein lying within a radius of not less than one mile of any proposed well, in consideration of the probable increase in value to such land and/or mineral rights therein incident to any discovery of potash and in order to prevent profiteering, to enter into an agreement whereby the Secretary of the Interior and the Secretary of Commerce, jointly, are empowered to act as referees in determining the maximum price at which the potash rights in such lands can be sold, which covenant shall run with the lands and/or mineral rights therein: *And provided further*, That the owners of such potash rights, in consideration of the advantage accruing from an equitable price for such potash rights as effected by said Secretary of the Interior and Secretary of Commerce, may be required to enter into an agreement whereby the potash produced from said lands shall be marketed at a price not in excess of a maximum determined by the Secretary of the Interior and the Secretary of Commerce jointly as equitable."

A Trace and a Trace

IN THESE DAYS, when outcrops of rich ore are few and far between, exploration generally has to be conducted on deposits that give reasonable promise of yielding profitable ore when and if enough digging has been done. To secure a patent on a claim, however, proof must be presented of the "discovery of mineral in rock in place." It is true, moreover, that silver and gold are constituents, even though in minute quantity, of nearly all rocks. As certain government engineers have expressed it, most country rock—like sea water—contains a "trace" of gold and silver. Accordingly assays reporting a "trace," they have contended, are not convincing evidence that the formation from which the samples came answers the specifications of being "mineralized" in the sense required by the statutes.

C. A. Schempp, chemist for the Tintic Standard Mining Co., of Utah, recently has pointed out a nice distinction between two interpretations of the word "trace" that is highly important in dealings of claim patentees with the United States Land Office. He recently has made several thousand fire assays for silver from certain limestones in the Tintic district. The customary half-assay-ton sample is used and the procedure is that of the normal fire assay. In no case, however, has a particle of silver large enough to be seen in the cupel with the naked eye been obtained from rocks other than those of the types in which orebodies have been found in the district. The usual habit of custom assayers is to report as a "trace" an assay that yields, with a half-ton sample, a bead large enough to be observed, but too small to be removed, cleaned, and weighed in the ordinary manner. This is the meaning of "trace" in the practical sense.

If the silver content of sea water or country rock were to be determined, the procedure would be to concentrate a large quantity of the original material; if water, by evaporation; if rock, perhaps by leaching followed by precipitation or evaporation of the solvent liquor. Finally, a fire assay or a gravimetric analysis could be made to determine with precision the minute quantity of silver contained in the original material. The foregoing illustrates the significance of trace in a theoretical sense and in the sense that scientists use the term when they talk of the ubiquity of silver or gold.

The contention seems entirely sound that when a competent and reliable assayer reports traces of silver—explaining that his results are obtained from a half assay ton by recognized fire methods—a quite definite conclusion is justified: that the rock has been subjected to some geologic mineralizing agency distinct from the "primary" distribution of silver in the crust of the earth. It might be asked why the assayer does not use a large sample and determine the content accurately. The answer is that the cost would be too great and that no information of practical value would be obtained.

The Present Trend in Mining

NEVER BEFORE in the history of the country save at the very peak of the demand created by the World War have the mines of the United States been called upon to produce as much of the major industrial metals—copper, lead, and zinc—as they are turning out at the present time. In fact, the present production of these metals in the United States is very close to the maximum produced in any year of the war. For example, our copper production in 1925 was almost 50 per cent greater than in 1914 and only 12 per cent less than in the year of maximum demand during the war. Of zinc we produced about 30 per cent more in 1925 than in 1914 and only 13 per cent less than in the peak year of the war. And of lead, which has recently been referred to as a precious metal, so eagerly is it being sought, we produced over 600,000 tons in 1925, compared with only 537,000 tons in the maximum year of the war.

As to the precious metals, our production of silver last year was 16 per cent greater than in 1922, despite the fact that producers got only an average price of 69c. for their product last year, compared with $1 an ounce in 1922. The gold producers that survived the change in world conditions are managing to hold their own. Conditions that existed last year have continued over into the present.

Thus a condition in the industry of great and healthy activity is shown to exist. And how is the production of this large amount of metal being accomplished? Our production of non-ferrous metals is greater than ever before if we ignore the two or three years of the war, and yet the ore that is coming from our mines is for the most part low in grade—the lowest in most cases that we have ever mined. The largest producer of lead in the country is working ore that contains only 3½ to 4 per cent lead. The largest producer of copper in the United States is mining ore that averages 99 hundredths of 1 per cent copper. Another important copper producer, having a more difficult ore, is getting only 14.7 lb. of copper out of each ton of ore. A well-known gold producer is mining ore underground that in 1924 ran only 87c. per ton in gold and from which in that year it produced almost $2,000,000. If we want to step across the border we may find a silver producer, whose work is typical of many other operations, who is working an ore containing only 5¼ oz. of silver per ton.

All these are great achievements that not so many years ago would have been thought impossible. They are the result of the application of engineering and metallurgical skill in the development of mining methods and ore-treatment processes that will lower costs. Hand in hand with this development of new methods and processes has gone and is going the adoption of modern equipment. Equipment is cold-bloodedly scrapped whenever something better makes its appearance. Plants have been completely remodeled whenever a new and cheaper process is found. Some plants are in a continual state of gradual change. Electrified plants have taken the place of steam-operated plants, and the process of electrification is still going on. Machinery has been substituted for hand labor, and, now, automatic control of machinery is still further lessening the dependence of industry on the manual worker. Mechanical haulage is more and more doing away with the trammer, and mechanical mucking and slushing are displacing the shoveler. All these changes are continuing, and the net result is that metal is being produced relatively more cheaply today than ever before. Mining, once almost exclusively a manual operation, today is largely mechanicalized. Not only is the machine being substituted for hand labor, but the tendency is toward larger machines.

Large as the use and consumption of metals are today, the industry looks ahead to still greater—much greater—consumption. To take care of the future needs, a most intensive search and prospecting for new ore deposits is in progress, not only in this country but all over the world. Prospecting does not consist merely in examination and inspection, but in the erection of many temporary mine plants and test plants and in the spending of large sums merely to find out whether a mineralized formation will pay to work or whether it must be left for a later day when improvements in process and equipment will have been carried forward to such a point that the deposit will be commercially profitable. This search for new ore is one of the most striking features of the present trend in the industry and holds much promise for the future.

Electric Welding

IMPORTANT DEVELOPMENTS in science and industry at times come suddenly upon us before we are well aware of their beginnings. The radio was one of these. Another is electric welding. The value of the welding rod and the gas torch for fabrication and repair work and of the latter for cutting metal has been amply advertised. Quick repairs by welding have averted many a shutdown. On this the superintendent and master mechanic are in general well informed. But the extent to which electric welding may be used in place of riveting in fabrication is scarcely realized. One large manufacturer has found that its adoption has given him an advantage over his competitors. Unable to compete with him in price, and not understanding the reason why, these competitors have at times assumed that he was simply undercutting, whereas in fact he was making as good a profit or better than he had ever made with riveting. He asserts that 75 per cent of riveted material can be made by welding, with a 100 per cent perfect joint, whereas a riveted joint is only about 75 per cent efficient. In riveting, considerable metal is removed that is not entirely replaced by the rivets and the plates are strained by punching.

In Canton, Ohio, the first commercial steel building—a two story structure—has been built by welding. A feature of this work is the absence of the riveting hammer's old familiar noise. A difficulty here would seem to be the matter of inspecting the welded joint. Ways of facilitating this should be found as experience is gained. Castings of many sorts have been duplicated in welded steel, the finished product, it is said, being lighter, stronger, more dependable, and cheaper, and, further, the time required to turn them out is a small fraction of that taken to produce the castings, with their preliminary careful design and pattern making.

It is in making quick repairs that welding can most advantageously be used in mining. But those operators with large shops, who make their cars and skips and other steel equipment, may find it worth their while to see what saving they can make by welding where they hitherto have riveted. Welding of this sort is a far simpler operation.

Mining Engineers of Note

Lucien Eaton

ONE OF THE BEST-KNOWN ENGINEERS of the Lake Superior iron country is Lucien Eaton, of Ishpeming, Mich. For the last sixteen years Mr. Eaton has served the Cleveland-Cliffs Iron Co. as superintendent of its mines in the Ishpeming district. It was in July, 1902, that he joined the company's engineering force, and in the eight years succeeding he rose step by step to his present position. Part of this time he spent as superintendent of the Iron Belt and Shores mines, at Iron Belt, Wis. In 1909 he went to Ishpeming as superintendent of the Cliffs Shaft mine and of the Moro and Salisbury mines, and the following year, on taking charge of the Lake and Imperial mines also, he became district superintendent.

The Cleveland-Cliffs company has long been a leader in iron-country mining practice, manifesting its leadership in many ways. About 1910 Mr. Eaton brought the first Leyner drills to the Marquette range and spent much time in increasing their efficiency. In 1912 he designed and built the first anvil-block chuck used with this type of drill, but took out no patent, instead offering the device without restriction to the industry. In 1916 he opened the Holmes mine, in Ishpeming, sinking a shaft 1,116 ft. deep and putting the mine on a production basis in less than fifteen months from the time the location of the shaft was decided upon. This shaft still holds the range record for sinking.

Two unique shaft houses of artistic design add to the landscape at the Cliffs shaft property, almost in the residential part of Ishpeming. They are of reinforced concrete and were built by Mr. Eaton in 1919. Since then he has been much interested in mechanical loading and has had much to do with development of the use of scrapers in both hard and soft ores. Mr. Eaton has served as chairman of the underground loading committee of the metal mines division of the standardization branch of the American Mining Congress for four years and has given much study to the application of standardization to mining.

While at Iron Belt, Wis., Mr. Eaton took much interest in politics and was chairman of the county board of supervisors for over two years. He is a member of the A.I.M.E., of the Mining and Metallurgical Society of America, and of the Lake Superior Mining Institute. In May, 1918, he was commissioned a captain in the Engineer Corps of the Army and remained in service with troops in this country until after the armistice, when he returned to his old position. Last year he spent five months in Peru as resident director of the Inca Mining & Development Co., operating the Santo Domingo mine, the first of June finding him back in Ishpeming.

Mr. Eaton was born in Saint Louis, Mo., on July 6, 1879, his father being a lawyer and editor of *The American Law Review*. He graduated from Harvard with distinction in 1900, and from the Lawrence Scientific School in 1901, specializing in chemistry and metallurgy. The following year he was assistant instructor in assaying and milling and took a master's degree in economic geology.

The Illinois-Kentucky Fluorspar Industry

Steel Makers Use 85 per Cent of Production—Demand Less Than Available Supply and Mill Capacity—Wages Compare Favorably with Those of Western Metal Mines

By Albert H. Fay
Assistant Editor

EIGHTY-FIVE PER CENT of the fluorspar used in the United States goes into the manufacture of steel. This amounts to about 8 lb. per ton of steel produced. The remaining 15 per cent may be divided as follows: In the manufacture of glass and enamel ware, 5 to 6 per cent; foundry, 2 per cent; acid and aluminum, 4 to 5 per cent, and the remainder in other industries. Of the 176,000 tons available for consumption in 1924, the domestic production was 125,000 tons, and imports amounted to 51,000 tons. The principal states producing fluorspar are Kentucky, Illinois, Colorado, and New Mexico, of which states Kentucky and Illinois produce about 88 per cent and Colorado produces 11 per cent.

During the high prices of 1918, 1919 and 1920, mines and mills worked up to capacity, which was greater than the steel industry requirements. This resulted in an accumulation of fluorspar stocks at the steel plants, which in 1920 was 66,000 tons, and also large stocks at the mines awaiting shipment. These stocks have been reduced materially since 1920, until at the close of 1925 the stocks were reported as about 69,000 tons at the mines and 49,000 short tons at the furnaces. These large stocks on hand have depressed the markets, as furnace operators will buy only special grades as long as they have fluxing material on hand. Another point to be taken into consideration is that imports have been increasing since 1921, which practically shuts the Kentucky-Illinois operators out of all markets east of Pittsburgh. The amount imported in 1925 was 48,700 short tons, valued at $9.63 per ton, compared with domestic production of 113,600 tons, valued at $18.06 per ton. The principal imports for years have been from the United Kingdom, followed by Germany and

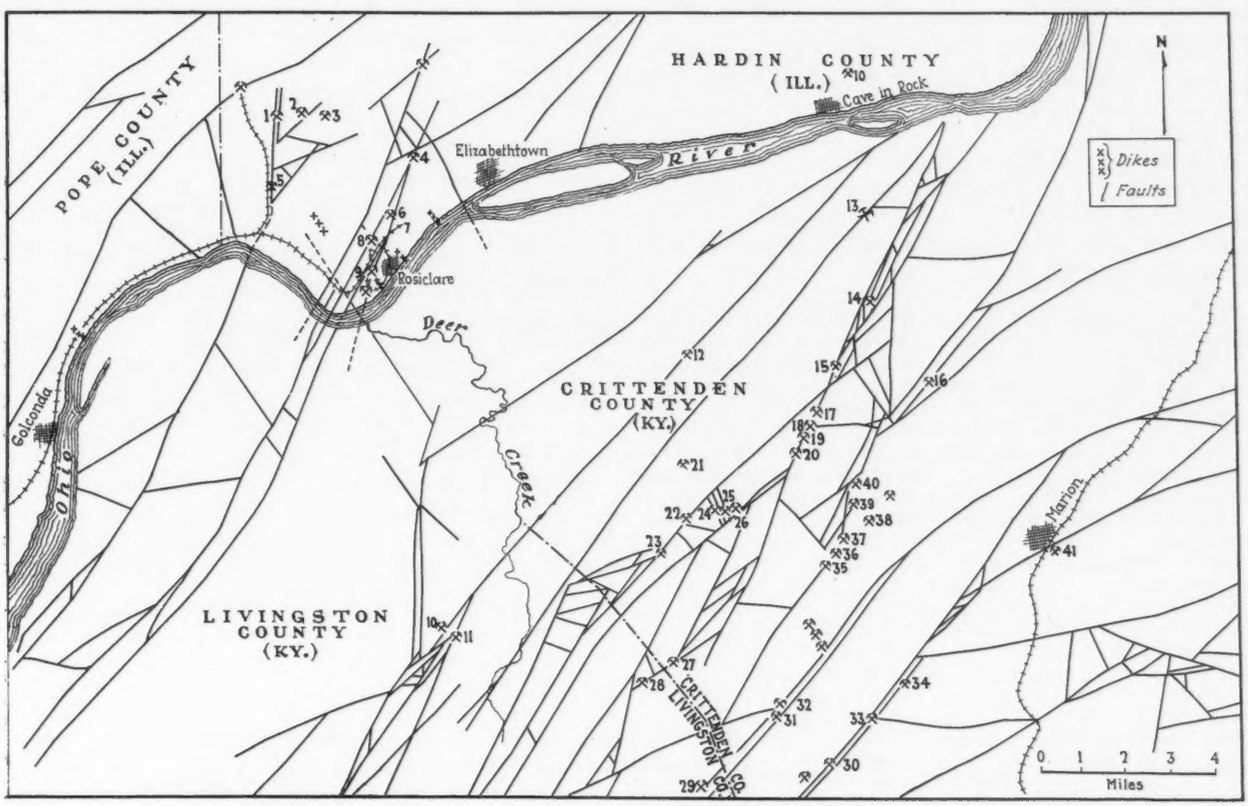

Fig. 1—Map of Kentucky-Illinois fluorspar district, showing faulting. Compiled from maps of the Kentucky, Illinois, and U. S. Geological Surveys

THE names of mines or groups of mines shown on the map ars as follows:

1. Pell
2. Twitchell
3. Preen
4. Clement
5. Miller
6. Daisy
7. Hillside
8. Rosiclare
9. Fairview
10. Cave-in-Rock
11. Bonanza
12. Sullinger
13. Spring
14. Beard
15. Bellman
16. Memphis
17. Commodore
18. Hickory
19. Glendale
20. K. K. Mine
21. Gray
22. Miller
23. Corn
24. Holly
25. Crystal
26. Big Four
27. Bachelor
28. Guill
29. Cullen
30. Ebbie Hodge
31. Pope
32. Eagle
33. Susie Beeler
34. White
35. Keystone
36. Ada Florence
37. Franklin
38. Old Jim
39. Mary Belle
40. Columbia
41. Lucile

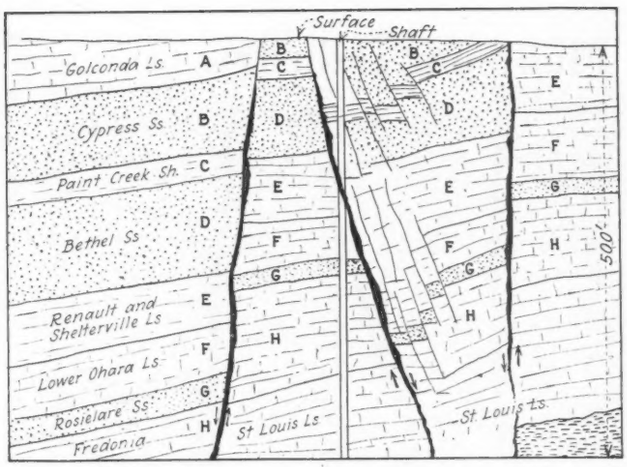

Fig. 2—Idealized section (after Weller) to show vein relationship and stratigraphy at Blue Diggings shaft, Rosiclare, Ill. Shaded portion is vein material

British South Africa. France and Italy are entering the export market with fluorspar, a part of which finds its way to the United States. The present duty is $5 per ton.

Both igneous and sedimentary rocks occur in the Kentucky-Illinois district. The former are represented by a number of dikes found near the Ohio River, and all are, so far as known, of the same general class of rocks. Bain[1] says:

"The sedimentary formations represent four systems, namely, Devonian, Carboniferous, Tertiary and Quaternary. In no case has a dike been traced any considerable distance, and with few exceptions they are found only in the bluffs along the Ohio River. The majority of the rocks in the dikes are lamprophyres and a few mica peridotites. At Rosiclaire, Ill., two dikes occur about 10 ft. apart and each about 10 in. thick, both vertical, and do not indicate any faulting. Diabase specimens have been obtained near Rosiclaire, but these are probably from glacial drift, as no diabase rock has been found in place. Between Rosiclaire and Fairview there is a well-defined dike extending north 31 deg. and 30 min. west, 4 to 5 ft. thick with small horizontal intrusive sheets extending into the sedimentary strata. No faulting is indicated. The majority of the faults are practically vertical. The Rosiclare fault vein is vertical. The Fairview vein dips 79 deg. 30 min. to the west, while the Empire vein dips 73 deg. to the east. Even these departures from the vertical seem on the whole to be exceptional, and the total effect of the faulting has been to divide the nearly horizontal rocks into a series of polygonal rocks, which have been raised or lowered with reference to one another and with very little horizontal displacement. The stratified rocks are often steeply inclined immediately adjacent the fault."

Secondary enrichment does not appear to have been a factor. Most of the fluorspar is crystalline, and in druses and open spaces well-defined crystals are frequent. For the most part the commercial fluorite occurs as vertical sheets or veins.

Deposits of fluorspar occur in Crittenden, Livingston, and Caldwell counties of western Kentucky, and in Hardin County, Ill. This area is covered by sedimentary deposits, which have been highly faulted in many places. (See Figs. 1 and 2.) The principal faults extend in a northeasterly-southwesterly direction and continue for many miles. The displacement varies from about 150 ft. vertically in southern Illinois at Rosiclaire to as much as 1,300 ft. in the Big Four fault in Kentucky.

After the faulting took place calcite partly filled the open spaces between the broken fragments of limestone and the main walls. The fluorine-bearing solution circulated through these partly filled fault spaces, filling up any remaining open channels and replacing the calcite in part. Where large orebodies occur, replacement seems to have been an important factor. According to L. W. Currier[2]:

"The structural and textural features of the vein point to two general processes by which the minerals were deposited—that is, by precipitation from super-saturated solutions in more or less continuous open fissures and cavities, and by the metasomatic action of solution upon previously deposited substances, whereby an earlier mineral was partly dissolved and replaced by a later mineral, through the simultaneous solution of the former and precipitation of the latter."

Some of the fluorspar deposits contain more or less zinc and lead in the form of sphalerite and galena. The occurrence of these two minerals indicates that they were deposited after the calcite and fluorite. Apparently there was slight faulting and disturbance after the primary deposits were made, thus leaving slight fissures (note Fig. 3) and openings through which the mineralized water flowed and precipitated the zinc and lead sulphides. Following the deposition of the sulphides some quartz was next deposited. Most of the quartz appears as microscopic particles, possibly introduced with the sulphide minerals accompanying sphalerite more than the galena. Interstices and fracture planes in fluorspar in many instances have been filled with silica, and silica has also been deposited on the outer surface of many of the fluorite crystals. Silica is therefore included within fractures and adheres to fluorite crystals to such an extent as to often reduce the value of the spar.

Pinches and swells occur along the vein, and the orebodies sometimes reach a width of 30 ft. or more, but the average is about 4 ft. Excepting for alteration of the minerals that has been effected by surface

[1] H. Foster Bain: "The Fluorspar Deposits of Southern Illinois." U. S. Geological Survey, Bull. 255. 1905.

[2] Louis W. Currier: "Fluorspar Deposits of Kentucky." Kentucky Geological Survey, Ser. VI, Vol. 13, p. 57. 1923.

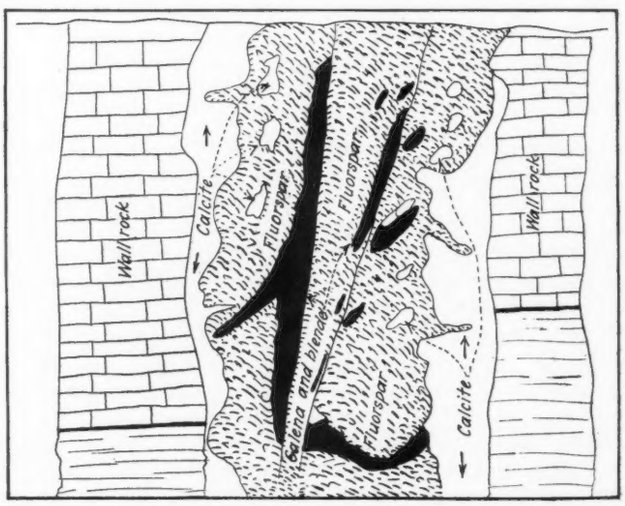

Fig. 3—Idealized section (after Weller) of fluorspar veins, showing general relationship between wall rock, minerals, and center slips. The white areas are calcite, stippled areas fluorspar and black areas sulphides of lead and zinc

waters, the same minerals that occur near the surface occur at depth. Zinc carbonate deposits occur in part as reconcentration of eroded veins, and the "gravel" fluorspar likewise results from broken-down veins, after the calcite has been dissolved.

Fohs[3] says: "Deposits are enormous, and in Livingston County there are 162 miles of fault zones or major lodes. Crittenden County has as much or more. Caldwell County also has much faulting and extensive ore zones. Christian, Lyon, and Trigg counties also contain some fluorspar." Fohs estimates the Kentucky total as approximately 200 million tons. In Crittenden County there are 127 mines and prospects, in Livingston County 50, in Caldwell County 19, in Christian County 8, in Lyon County 6, and in Trigg County 11.

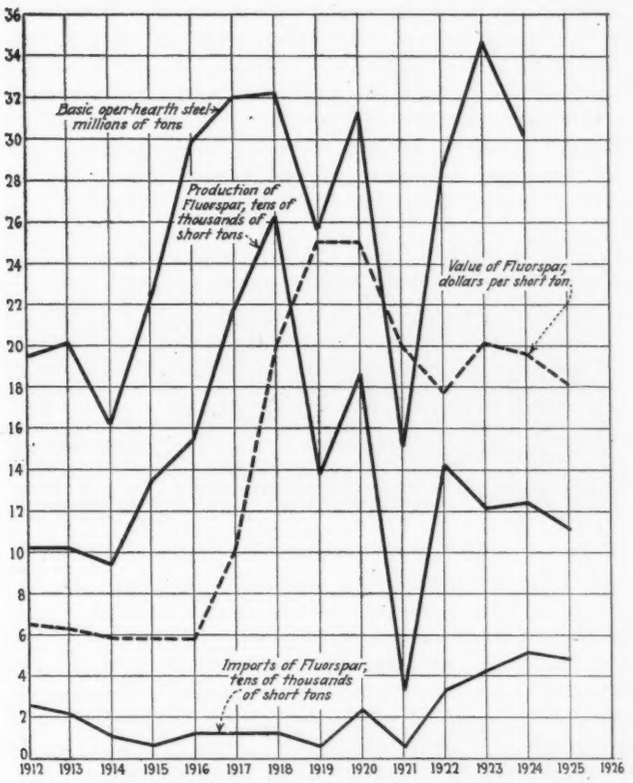

Fig. 4—Chart showing prices, production, and imports of fluorspar compared with the production of basic open-hearth steel

Weller[4] says that, "In places fluorspar occurs in flat lying tabular masses, forming a part of the series of sedimentary rock. Such occurrences are not so abundant as the veins, and owing to the thinness and impurities they have been subjected to but little exploitation. Locally these are called 'blanket formations.'"

The veins of greatest economic occurrence are those along these faults. The best mineral is found in areas where one wall consists of the lower thick St. Genevieve limestone. Where both walls consist of sandstone, shale, or thin limestone, conditions do not seem so favorable for the deposition of large, workable deposits.

The major part of the ore occurs in true fissure veins and is mined as such. There are, however, some

[3]F. Julius Fohs: "Fluorspar Deposits of Kentucky." Kentucky Geological Survey, Bull. No. 9. 1907.

[4]Stuart Weller: "The Geology of Hardin County and the Adjoining Part of Pope County." Illinois State Geological Survey. Bull. 41. 1920.

Fig. 5—Plant of Rosiclare Lead & Fluorspar Co., Rosiclare, Ill.

surficial deposits which have resulted from the weathering of vein outcrops. In these cases the fluorspar occurs as small gravel or pebbles, and is distributed through a body of clay material. The calcite has been dissolved, leaving the fluorspar practically free with the exception of a small amount of quartz, which it may contain as indicated above. The only mechanical preparation which the gravel spar requires is a thorough washing in a log washer, which separates the clay and delivers a clean gravel product. Most of this will yield an 85-5 spar, or a higher grade may be made by concentrating in jigs and following with tables. The sphalerite in these surface deposits has been converted to carbonates; the small amount of lead that occurred as galena is still in existence as the sulphide.

Milling Capacity

There is, on the whole, a milling capacity in excess of market demands. A number of local holders of fluorspar property seem to feel that the mines as at present developed cannot produce sufficient ore to run the mills at full-time capacity. However, those actually producing fluorspar do not hold such a pessimistic view, believing that there is yet ample ore to meet all demands, but acknowledging that the milling capacity is in excess of the immediate consumption. The larger companies are acquiring additional acreage along the faulted areas, and holding for future development.

The fluorite industry is one that must be content with a small tonnage, as it is almost entirely dependent upon the great basic industry—iron and steel. Only when the general business conditions are good and the steel industry is working at full capacity can the spar industry expect good business. Fluorite is one of those minerals for which artificial markets cannot be created. There is, however, one possible opportunity for expansion and that is in the manufacture of cement, as is being done to some extent in Germany. By the introduction of ground fluorspar in the cement kiln it is possible to produce a cement clinker at a much lower temperature, some authorities giving it as much as 500 deg. F. If this is true, its use would effect an enormous saving in the amount of coal used in the kilns. The majority of the mines can produce a large amount of fine spar containing 5 to 10 per cent of silica. It is worth while to make an effort to see what can be done to create a market for the low-grade fine material. To meet the demand for acid spar, even though the tonnage is small, it is necessary at present to mine an excess of the lower grades, with the result that the market is over-supplied with fluxing materials.

Fluorspar used in the steel industry must be practically free from sulphur, the specifications calling for

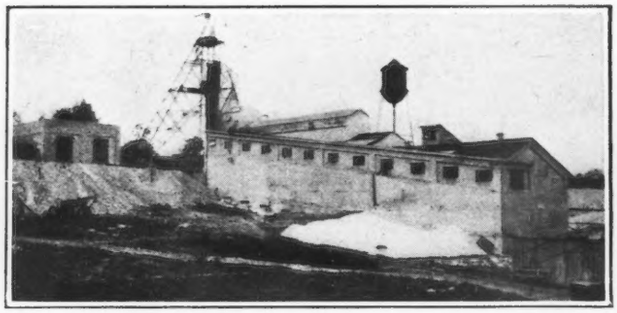

Fig. 6—Plant of Hillside Fluorspar Mines, Rosiclare, Ill.

Fig. 7—Miners' cottages, Hillside Fluorspar Mines, Rosiclare, Ill.

0.3 per cent or less in sulphur, and silica 3 to 5 per cent. For the steel industry the iron is not deleterious, but for glass manufacture iron must be eliminated, as a small percentage of iron will discolor the glass. In the manufacture of aluminum an excess of silica will make the aluminum hard and brittle; hence, the silica limits must not exceed 1 per cent. Fortunately, the Kentucky-Illinois fluorspar contains little or no sulphur except as it may occur in combination with the associated minerals—barite, sphalerite, galena, and gypsum. These are all much heavier than fluorite, and can be separated, the lead and zinc content being a valuable byproduct. Barite and gypsum do not occur in sufficient quantities to be of commercial importance even if saved.

Principal Operators and Present Annual Rate of Production on Basis of One Eight-Hour Shift

	Tons
Franklin Fluorspar Co., Paducah, Ky	15,000
Keystone Mining Co., Hopkinsville, Ky	12,000
Lafayette Fluorspar Co., Mexico, Ky	12,000
United Mining Co., Lola, Ky	3,000
Crider & Rinz, Mexico, Ky	3,600
W. K. Woods, Smithland, Ky	1,500
Holly Ore Mining Co., Marion, Ky	3,000
Independence Fluorspar Co., Marion, Ky	4,000
Eagle Fluorspar Co., Salem, Ky	6,000
Rosiclare Lead & Fluorspar Co., Rosiclare, Ill	30,000
Hillside Mining Co., Rosiclare, Ill	15,000
Others (small wagon mines)	10,000
Total	115,100

The grades of material marketed are: Acid spar (usually hand-picked lumps, or high-grade gravel from the jig) for use in the manufacture of aluminum and acids. The second grade, 95 per cent CaF_2 and 3 per cent silica, is usually ground at the mine or mill and shipped in bags for glass manufacture. It must be white, the standard being pure white spar, and contain less than $\frac{1}{10}$ per cent iron. For the steel-furnace flux the principal grade shipped is 85-5 to 95-3. A lower grade is frequently shipped, but this is penalized for the deficiency in calcium fluoride. No premium is paid for fluorspar in excess of the 85 per cent.

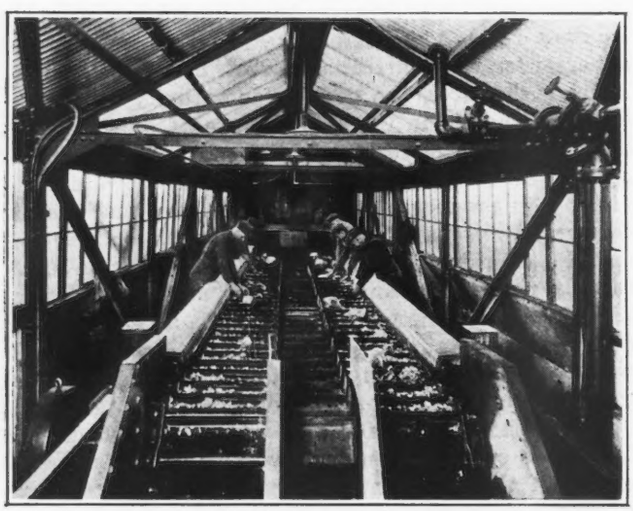

Fig. 8—Picking belt, Hillside mill. Waste is thrown out. The center compartment is for selected lump acid spar

The fluorspar deposits of western Kentucky and southern Illinois have a variety of spar known as optical fluorspar. Pogue[5] says this spar, because of its low refractive power and very weak color dispersion, is especially suitable for correcting spherical and chromatic errors in lens systems. It is also used in making prisms for spectrographs employed in ultra-violet work and for use in other optical apparatus, in cases where great transparency to ultra-violet and infra-red parts of the spectrum is required. It is also employed as part of the lens system in telescopes to correct certain color effects. For optical uses a specimen must contain a portion at least $\frac{1}{4}$ in. in diameter free from flaws and colorless or nearly so. The value of optical fluorite cannot be expressed in definite figures, for it is a specialty and not a staple product.

Fig. 9—Hoist and mill at Haffaw mine, Franklin Fluorspar Co., near Marion, Ky.

MILLING PRACTICE

Under present milling practice the difficult problem is to separate the adhering and oftentimes intermixed silica from the fluorspar. Fair results can be obtained by very fine grinding, but this is costly and in turn gives an excess amount of non-marketable products, under the present requirements and specifications of the steel industry. A cheap milling process that will eliminate silica yet leave the fluorspar as large as a coarse sand is desirable. If, however, the high-silica spar can be used in the cement industry, the major

[5]Joseph Ezekiel Pogue: "Optical Fluorite in Southern Illinois." Illinois State Geological Survey. Bull. No. 38; pp. 419-425. 1922.

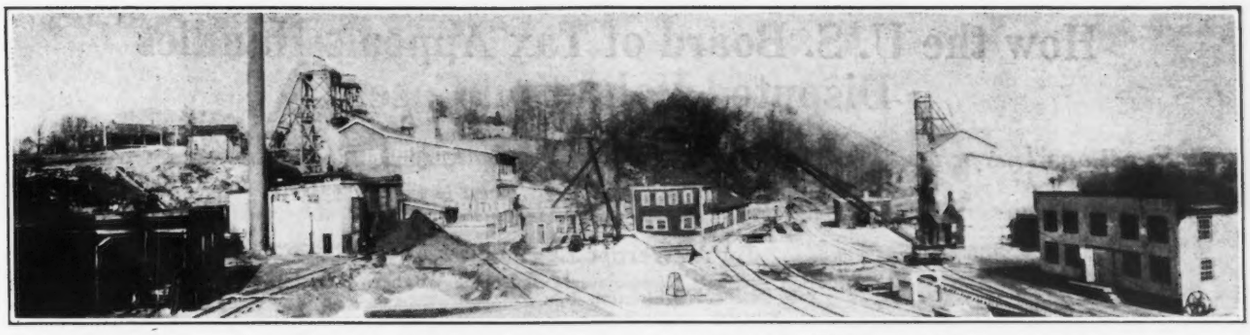

Fig. 10—Fairview mine and plant, Franklin Fluorspar Co.

problem has been solved. It would then be possible to utilize the excess mined as a ground product. Study, experiment, and research wherein comparisons of the physical qualities of quartz and spar can be made would seem to be in order. One of the possibilities that might be given consideration is in the coefficient of expansion of the two minerals, wherein a low temperature applied to spar ground to a size of ⅛ in. or less might be productive of fracturing along the planes of adhesion between the fluorspar and the silica, so that with further grinding the two minerals would separate and yet remain as a fairly coarse sand. The silica once separated can then be eliminated by jigs and tables.

Milling equipment at present consists of crushers, trommels, classifiers, jigs, and tables. The Harz type of jig is commonly used, both as a single- and double-plunger jig. The crushed material, about ⅝ in. in size, is fed to the jig and separated from the calcite and quartz. Tailings are reground and passed over finer jigs, so that the last jig handles material about 1/16 in. in diameter. Anything less than this goes to the tables for final separation. The tailings from the mills contain 10 to 12 per cent of silica. Where there is some zinc and lead in the ore, the coarse lead and zinc are saved in the jigs, and there is also a separation of the finer products on the tables. An attempt is now being made to separate the spar from the silica by flotation.

All laborers employed at the mines and mills are English-speaking American citizens. No foreign labor is employed at any place in the district. No negro labor is employed in the mines or mills. The district is operated on the open-shop basis, although attempts have been made to unionize it by emissaries from the coal miners' union at Herrin, Ill., and other near-by places. Wages compare favorably with those paid in metal-mining districts, especially Colorado. Local miners receive $4 to $4.50 for an eight-hour shift. Timber men and hoist men $4.50 to $6, and common laborers, including muckers and trammers, $3 to $4 per day. These wages apply especially to the Illinois portion of the district; for Kentucky the rate is about 50c. per day less. The majority of the miners live in so-called "company houses," Fig. 7, for which they are charged from $5 to $7.50 per month for four rooms; garage, $2 extra. Water in most cases is piped to the door and is free; electric light is furnished at a flat rate of $1 per month, with no meter reading. Coal may be purchased in the open market, or is frequently supplied by the company at cost, which is usually $3 to $4 per ton. About 350 men are employed in the Illinois field and 450 to 500 in the Kentucky field. When the demand for ore exceeds the capacity of the local miners, additional labor is recruited from the neighboring farms.

Machine Shop of the Consolidated Mining & Smelting Co., Tadanac, B. C.

How the U. S. Board of Tax Appeals Handles Disputed Valuation Cases

Functions Independently of the Bureau of Internal Revenue—Strict Rules of Evidence and Procedure Enforced

By A. Werner Lawson
Valuation Engineer: Associate of Wilson & Wagner, Washington, D. C.

THE United States Board of Tax Appeals was provided for under the Revenue Act of 1924. The creation of the board was fostered by the best authorities and advisers to both the Treasury Department and Congress to replace the Committee on Appeals and Review, which was a departmental body in the Bureau of Internal Revenue. The function of the Committee on Appeals was to adjust disagreements between the taxpayer and various sections of the Income Tax Unit, and to act as a representative of the commissioner in cases where the taxpayer appealed to him from decisions of the unit. It became apparent, however, that it would be desirable to divorce completely from the sphere of the bureau any body exercising such functions, and to have the bureau function impartially and entirely independently. With this end in view, and in part in the nature of an experiment, Congress deemed it wise to establish a quasi-judicial body or board whose functions should be to review the findings of the commissioner relative to deficiencies in tax liability and to make determinations of the proposed deficiencies if such action were warranted. In the event, however, that the action of the board did not prove acceptable to either the taxpayer or the commissioner, the dissatisfied party had recourse to the courts for final determination. In the case of the former, however, the tax must be paid and suit for refund filed, and in the case of the latter suit for collection must be brought.

To preserve as much as possible of the quasi-judicial atmosphere in which the board was conceived, and to divest it of the formality attendant upon regular court procedure, the provisions of the act under which it was created prescribed that "the proceedings of the board and its divisions shall be conducted in accordance with such rules of evidence and procedure as the board may prescribe." In other words, the entire proceedings of the board, rules for practice, rules of evidence, and other like details, were optional with the board. It was thought by many taxpayers that the interpretation of this provision by the board would result in its organization on the basis of a strictly informal conference board wherein the former could meet with the individuals of the board in a businesslike way around the conference table and thresh out their differences with the representatives of the commissioner's office and close their cases in a practical, expeditious manner. However, the provisions creating the board also prescribed that "in any proceeding in court . . . and in any suit or proceeding by a taxpayer to recover any amounts paid in pursuance of a decision of the board, the findings of the board shall be prima facie evidence of the facts therein stated." In view of this provision the board thought it should function in a more orderly and consistent manner than would have been possible without strict and relatively formal rules of procedure and practice. Consequently, when its rules of practice were promulgated it was found that the board had clothed itself in the matters of pleadings, motions, evidence, and such detail with a formality closely akin to that of the courts of equity. It has been a lack of appreciation of this fact and a lack of the observance of the requirements of the board on the part of the appellants that have been in a large measure responsible either for the dismissal of many cases without a decision on their merits or, after due hearing, decisions adverse to the taxpayers due to incompleteness of the record or the insufficiency of the evidence to sustain their contentions.

Scope of Board Broadened in 1926

Congress, in the Revenue Act of 1926, gave serious consideration to the Board of Tax Appeals, and felt that its activities and record during the first eighteen months of its existence had fully justified its creation and warranted its continuation, with even more defined powers and broadened scope, as an independent agency in the executive branch of the government. The permanent personnel of the board was increased from seven to sixteen members with terms of office ranging from six to twelve years, and their remuneration increased to an amount that would make appointment to it attractive to the best-qualified and experienced men. Many of the rules of practice, promulgated by the board itself under the 1924 act, were validated and incorporated in the law under the provisions of the 1926 act. There are, moreover, included two new important provisions relative to the procedure of the board. These have to do with the questions of evidence before the board and appeals from its decisions.

Rules of Evidence Mandatory

Under the procedure in force prior to the passage of the 1926 act, the rules of evidence, as has been pointed out, were optional with the board. Under the new act the rules of evidence before the board are mandatory. In this connection, Section 907 (a) of the act provides that "the proceedings of the board and its divisions shall be conducted in accordance with such rules of practice and procedure (other than rules of evidence) as the board may prescribe *and in accordance with the rules of evidence applicable in the courts of equity of the District of Columbia.*" Consequently, so far as regards the submission of evidence in any case before the board, it is clothed with all the formality and dignity of the United States district courts. The appellant to the board must be prepared, in submitting his case, to present his evidence, whether by documentary or by oral testimony, in accordance with such rules.

The second important change has to do with appeal to, or review by, the courts of board decisions. Under the prior procedure recourse from board decisions could be

had to the district courts by either the commissioner or the taxpayer, as the case might be. However, such action was not so much in the nature of an appeal or review by the court as it was a trial *de novo* on the questions involved, although the findings of the board were to be taken by the court as "prima facie evidence of the facts therein stated." Under the new procedure, the district courts are eliminated, and the appeal from the board findings is taken directly to the Circuit Court of Appeals. Thus, only in cases where the tax has been paid without appeal to the board does the taxpayer have recourse to the lower courts. For all other cases involving deficiencies in federal income and profits taxes, the Board of Tax Appeals is given the status of the district courts, and for all practical purposes replaces them in these matters. The Circuit Court of Appeals bases its review upon the findings of fact, evidence, and testimony contained in the record of the case before the board. Arguments to the Appellate Court must be based upon the record of submission before the board, and *supplementary evidence may not be submitted.* This procedure has the twofold effect of causing the board to exercise the same care and strictness as to the character and admission of evidence to the record, and of compelling the taxpayer to prepare and present the supporting evidence and testimony for his contention with the same care, completeness, and sufficiency, that would be exercised in its presentation to a federal district court.

Without applying the strictness of the rules of evidence of the district courts of equity, the board itself recognized the necessity and importance of completeness and sufficiency of evidence in the record in the procedure under the provisions of the 1924 act. Accordingly, Rule 18 in the "Rules of Practice" was established. This provided that " . . . an appeal in which issue has been joined and in which no issue of fact is raised, or a contested motion not predicated upon an issue of fact, in which both parties are not present in person or by counsel at the time it is called for hearing, will be regarded as submitted on the part of the absent party or parties. Where there is a joinder of issue on questions of fact the provisions of this rule relative to submission without argument *shall not relieve the party upon whom rests the burden of proof, of adducing at the hearing proper evidence in support of his contention. Pleadings do not constitute evidence and where issues of fact are joined, failure to adduce supporting evidence will be taken as ground for dismissal.*" Rule 20 provided that the "burden of proof shall be upon" the taxpayer.

Findings Based on Written Record

The board makes its findings and decisions upon the written record of the testimony and evidence adduced at the hearings. Regardless of the merits of the taxpayer's contention, if complete and sufficient evidence to clearly substantiate it is not in the record he will naturally sustain an adverse decision. Part or all of the data and testimony may have been at various times submitted to the bureau, but if it is not resubmitted in the form of admissible evidence, or strong additional evidence added to it and placed in the record before the board by the taxpayer, it is of no avail. The mere pleadings as to error on the part of the commissioner or bureau, without all the evidence to support the allegation, are fruitless. The board will not, nor in fact can it, go into data or facts on file in the bureau, looking for evidence to sustain the taxpayer. Though this was true under the prior procedure, it is even more so under the present procedure, with its strictness of rules of evidence.

Moreover, there is in this connection another consideration of the utmost importance embodied in the provisions of the 1926 act relating to appeals filed with the board subsequent to the passage of the act. In all appeals under the 1924 act the board shall retain jurisdiction, and all the rights of the taxpayer relative to appeals to the courts pursuant to the provisions of that act are retained. Under the 1924 act, if the taxpayer appealed to the board from only a portion of the deficiency determined by the commissioner, or if his pleadings only included allegation of error on the part of the commissioner with respect to a part of all the points involved in the deficiency he could afterwards bring suit in the courts on the whole case, provided the tax was paid and claim for refund filed and such claim was disallowed. His only limitation would be that the findings of the board are prima facie evidence of the facts therein stated.

The important thing to note is that under the new act this procedure has been radically changed for all taxpayers whose appeals are filed subsequent to its passage. Section 284, Subdivision (d) of the act provides that "if the commissioner has mailed to the taxpayer a notice of deficiency . . . and if the taxpayer after the enactment of this act files a petition with the Board of Tax Appeals within the time prescribed in such subdivision *no credit or refund in respect of the tax for the taxable year in respect of which the commissioner has determined the deficiency shall be allowed or made and no suit by the taxpayer for the recovery of any part of such tax shall be instituted in any court. . . .*" The effect of this provision is to bar the taxpayer from any further recourse whatever beyond the board except on those points included in his appeal and submitted on evidence for hearing to the board. In other words, the taxpayer waives all right of further appeal in respect of any determination of deficiency by the commissioner except on such parts of the deficiency and grounds therefor as he makes appeal on to the board in the first instance. From this is again seen the importance of completely covering the case in all its aspects upon appeal to the board, and of submitting conclusive evidence on all the points involved. However, if the taxpayer desires to retain his *status quo* before the courts, he has the right to pay the tax, file claim for refund at any time before the expiration of the statutory period, and to bring suit in the courts on any of the issues in any way he may see fit. In brief, the taxpayer has only two options: either appeal to the board on all the issues involved in the first instance or pay the tax and reserve by proper action recourse to the courts.

Natural Resources Cases Before the Board

Though the preceding observations have general application to all classes of cases pending before the board, those relating to matters of evidence have particular application to cases of valuation now pending. Questions embracing valuations of natural resources, and especially mining and oil properties, occupy a peculiar and specialized status as compared with the majority of appeals taken to the board. The questions involved may be roughly divided into two classes: those involving the interpretation of the provisions of the law or the regulations applicable to them, and questions of fact. Though the same classifications may or may not have

application to natural resource valuations, depending upon the peculiarities of the case, there is involved in the latter a third most important consideration peculiar only to them. This is the question of judgment or opinion, which forms so large an element in the estimates involved in the valuations of these properties, and the application of sound and accepted engineering practice and procedure to them. Moreover, the reason for determining the valuation is, in practically every case, for the purpose of establishing a "reasonable allowance" for a depletion deduction from gross income. The valuation must be reasonable. The burden of proof falls on the taxpayer to establish convincingly that the commissioner has been unreasonable and, on the other hand, to submit proof that his own contention is not unreasonable. In view of the many peculiar and intangible factors entering into the valuations, even in the absence of any controversy as to questions of fact, it becomes very difficult to sustain such a contention without most comprehensive evidence and sound reasoning to support it.

THE Board of Tax Appeals is an independent body created to pass upon all cases that are appealed from decisions of the Commissioner of Internal Revenue. The Act of 1926 provides that the proceedings of the board shall be conducted in accordance with the rules of evidence applicable in the Court of Equity in the District of Columbia, so that it is clothed with all the dignity and formality of the United States district courts. Although the appellant has previously submitted to the bureau whatever data may be necessary to make a valuation, all such material must now be presented to the board in the form of admissible evidence. The material facts may be admissible evidence only in so far as each and every fact is susceptible of introduction as the testimony of someone personally familiar with the fact or facts as of the date under consideration.

Prior to the time of receipt of a sixty-day letter, most of the taxpayer's experience in the adjustment of his liability has been with the various sections of the bureau. There the procedure has been informal, with direct personal contact with the officials of the bureau handling the cases. After the original data or reports of the taxpayer have been submitted, and the bureau has made its findings, it issues a so-called thirty-day letter. Protests are then filed by the taxpayer, conferences held, additional data probably submitted, extensions of time granted if necessary, further findings by the bureau and probably still further evidence and data submitted, and so on. Frequently the data and evidence are submitted in piecemeal, and the case is argued out in the same way as various stages in the adjustment of the case are reached. This procedure still maintains before the bureau, but before the board the situation is altered. The taxpayer must make out his complete case on the submission at the hearing. All admissible material evidence as to physical conditions of the properties, quality of product, treatment, operating costs, treatment costs, life of property, costs of plant and equipment, geological or other reports, taxpayer's own valuation reports, and other data, should be introduced so that the board may have before it, in the record, all evidence necessary to make an independent valuation. If the taxpayer has, as has been done in most cases, submitted such data to the bureau as is necessary to make a valuation, and the taxpayer is dissatisfied with the determination thus made and has appealed to the board, then all such material data should be presented to the board in the form of *admissible evidence*. It should, in addition, be supplemented by an independent valuation based on such evidence by qualified experts.

Frequently the determinations of the bureau are based upon incomplete or insufficient data. In appealing to the board the taxpayer should be certain that the data introduced as evidence contain such further information as to make the evidence entirely sufficient to warrant a determination of a correct and reasonable valuation by the board.

Again, the taxpayer may be appealing from the complete or partial disallowance of a valuation based upon legal points involved in his case. If, in addition to petitioning for redetermination of the commissioner's findings as to the interpretation of the statute, the taxpayer is petitioning for a determination of the proper valuation in the event the commissioner is reversed, all evidence necessary for such valuation by the board should be in the record. The point it is desired to stress is that in all cases on appeal to the board where valuations are involved the taxpayer should submit in the first instance all competent, complete, and sufficient evidence to warrant the board in finding a determination justified, and to permit of its making such determination.

The term "evidence" as relating to the facts and data in substantiation of a valuation before the bureau and as it relates to the material facts in substantiation of a claim before the board has widely differing significance. In the case of the procedure before the bureau the taxpayer submits all of his supporting data or evidence to the Valuation Section on various prepared questionnaires with supplementary schedules, maps, and other details, where such are necessary. These are frequently accompanied, as a part of the questionnaire forms, by valuations, prepared by some qualified engineer, based upon the facts and information submitted. Such data and facts are usually taken from the taxpayer's records and books, and their correctness is sworn or attested to by the proper agents of the taxpayer. These data and facts, for the purposes of the bureau, constitute "supporting evidence." Based upon this evidence, the commissioner either affirms or disallows in part or whole the valuation claimed by the taxpayer.

Before the board, the term evidence has a much different significance. If, as is at present mandatory upon the board, the rules of evidence applicable to the courts of equity are strictly adhered to, then the facts and supporting evidence used before the board become evidence for the purposes of the board only in so far as they are admissible under such rules of evidence. The material facts and data may only be admissible evidence to the board, and be used by it in its findings, in so far as each and every fact or estimate is susceptible of introduction as the testimony of some person personally familiar with them or having personal knowledge of the conditions existing as of the basic date under consideration. It is equally true that the taxpayer's valuation, made by his engineers, can have no weight with the board except in so far as the valua-

tion is based upon the admissible facts in evidence and testified to by competent and qualified individuals.

It thus becomes proper to inquire what procedure should be followed to sustain to best advantage an appeal before the board involving questions of valuation. Up to the present time, only a few cases of this character have been decided by the board, and these were based upon evidence under the old procedure. Consequently, no fixed rule based upon precedent of the board itself has been announced.

It will be necessary for the taxpayer to build up his case step by step, presenting his material facts in the most complete form possible. Each factor entering into the valuation must be treated in its proper place and introduced in the form of admissible evidence into the record. This means that every item, such as general physical conditions, production records, costs of plant, treatment charges, reserves, and other data, and all the other factors peculiar to each case, must be testified to by some one with personal knowledge of the facts as of the basic date involved. For example, the engineer, general manager, or superintendent, or some one else equally conversant with the operations of the property, can furnish much of the testimony relative to the physical aspects, reserves, development, costs, and so on. Probably in many cases the accountant or auditor actively on duty and familiar with the records prior to or at the basic date may furnish much of the testimony relative to the records. The farther removed the basic date, the more difficult becomes the task of securing testimony on all these various points. However, some one of those who were in active touch with the operation is usually available.

Having finally, by competent testimony, placed all of his material facts and supporting evidence in the record and laid the foundation for his valuation, the taxpayer may either rest upon the facts in evidence, permitting the board to determine the valuation, or he may through competent and qualified expert testimony introduce his own valuation based upon the evidence. In this connection, it may be of importance to note that the personnel of the board is composed of men in general entirely unfamiliar with the technical considerations, engineering aspects, and questions of judgment and opinion gained only from wide, practical experience, that are involved in valuations of mining, oil, timber, and other natural-resources properties. In the bureau these valuations are considered and determined by engineers who are experts in their respective fields. The board, to arrive at a just and reasonable finding, must, in some measure at least, be advised and informed on these questions. It therefore behooves the taxpayer, that he may best sustain his case, to offer the board every assistance in the form of admissible expert testimony on the valuation and to submit his own valuations prepared by his experts. If such experts are familiar with the properties from personal experience as of the basic date, so much the better.

Bureau Handicapped in Appeals

It is to be remembered that the Valuation Section of the Income Tax Unit has on file all the facts and data previously submitted to it by the taxpayer relative to his properties. In addition to this, the officials of the Valuation Section have a vast fund of information relative to similar properties from which they could draw in basing their conclusions in cases under consideration before them. Moreover, the Valuation Section is, in a way, placed on the defensive in an appeal to the board from its findings. However, none of the facts and data in the possession of the commissioner will constitute admissible evidence before the board unless presented as the testimony of some of his engineers having personal knowledge of the facts of the basic dates under consideration. It is improbable that many, if any, of the commissioner's engineers have personal knowledge of the conditions existing at the various taxpayers' properties as of the basic dates involved. It seems, therefore, that so far as regards the introduction of the facts into evidence before the board the taxpayer has the advantage. With regard to the matter of expert opinion testimony as to the valuations, the commissioner and the taxpayer are, other things being equal, probably on a parity, except, perhaps, in cases where the taxpayer's experts can testify from actual personal knowledge as of the exact basic date. In the latter case the taxpayer again has the advantage.

At the present time, the Valuation Section of the Income Tax Unit has a department to which are assigned engineers whose function it is to assist the solicitor's office in the preparation of cases before the board for the commissioner. In view of the considerations set forth in the preceding paragraph, it appears that so far as questions of fact are concerned, these engineers cannot directly play an important part as witnesses. Indirectly, however, they may assist the attorneys of the solicitor's office in cross-examination of the taxpayers' witnesses. Based upon the facts in evidence, as introduced by the taxpayer, they may, however, when duly qualified, testify regarding their opinions as to the valuations.

In the final analysis, any questions as to determinations by the board of valuations for depletion or other deductions from gross income will depend upon the reasonableness of the commissioner's determinations. The methods employed are immaterial so long as the results are reasonable. Consequently, any abstract attacks by the taxpayer simply on methods employed are fruitless unless the method may be shown to be arbitrary and unreasonable. The more carefully the case is planned and the more complete the evidence in the record, the better able will the board be, or if necessary the Appellate Court, to judge as to the merits of the case and to render a just and reasonable decision.

Cases Pending Before Board

Included among approximately 9,000 cases pending before the United States Board of Tax Appeals on April 10 are about 600 petitions involving the natural-resources industry, which include oil and gas, coal and other non-metallic natural deposits, metal mines, and timber. There are in dispute the correctness or reasonableness of valuations made by the commissioner as a basis for depletion allowances and other allowable deductions from gross income as of March 1, 1913, or basic dates subsequent thereto. The latter involve either fair market value of properties acquired for stock, discovery valuations, or kindred questions. The Board of Tax Appeals has been petitioned by the taxpayers in these cases to make a determination either of a proposed deficiency in tax or of a tax deficiency actually assessed against them where the taxpayers have taken

the proper measures to stay the collection of the tax pending the hearing on appeal and final determination. Such determinations of deficiencies by the board, in so far as the deficiencies are the result of disallowances of valuations claimed by the taxpayers, naturally involve a thorough review of the findings of the commissioner and the various factors employed by him in respect of the valuations. If the commissioner is found by the board to have been either in error or unreasonable in his determination, it devolves upon the board to make a proper valuation based upon the facts and evidence submitted to it.

The 600 petitions referred to do not include a number of similar cases, that are now simply awaiting decision, upon which the board has already held hearings. Both classes, however, are cases which at one stage or another in their progress through the Bureau of Internal Revenue for audit and final determination of their tax liability have been referred to the valuation sections for determination or adjustment of factors involved in the taxpayers' claim for allowable deductions on account of depletion, amortization, and allied questions. Many of them had been pending in the bureau for long periods of time. Data were submitted, conferences held between the taxpayer and bureau officials, more data submitted, and further conferences held until it became obvious that no agreement between the bureau and the taxpayer could be reached. Eventually either a so-called sixty-day letter indicating the proposed deficiency in tax was issued, or the deficiency was assessed against the taxpayer. Under the proper procedure applicable to the two cases, the taxpayer's only recourse was either to appeal to the board for determination or to pay the tax, file claim for refund, and if the latter was not allowed within six months, sue in the federal courts. In case of a jeopardy assessment under the 1924 act the taxpayer's only recourse was to the courts. Under the 1926 act, however, in the case of jeopardy assessment, the commissioner must within sixty days from assessment issue a sixty-day letter, and the taxpayer then has the right of appeal to the board just as though the assessment had been proposed instead of actually assessed.

How soon hearings may be had on these pending cases, or decisions on those already heard may be anticipated, is problematical, but it is believed that many of the cases will be awaiting a hearing, or at least a decision, two or three years hence. The calendar of the board may be, from the best data available, summarized as follows:

Summary of Status of Calendar of United States Board of Tax Appeals

Total petitions filed June 2, 1924, to April 10, 1926...		13,286
Petitions dismissed (approximately)	2,790	
Decisions rendered (approximately)	1,594	
Total cases disposed of to April 10, 1926 (approximately)		4,384
Total petitions pending (*a*)		8,902

Cases Involving Valuation (b)

Oil and gas cases	162	
Mining-metal and non-metal cases	198	
Timber cases	120	
Appraisal and amortization cases	120	
Total cases involving valuation pending for hearing		600

(*a*) Includes both cases heard and awaiting decision and those still awaiting hearing.

(*b*) Includes only cases pending for hearing and does not include those heard and awaiting decision.

The foregoing figures show that the board has either rendered decisions on, or dismissed for cause, approximately 33 per cent of the total number of appeals filed with it since it began to function in July, 1924. It appears unlikely that in the future the ratio of cases dismissed to the total number of cases disposed of will be as high as during the last twenty-one months, when many petitions were dismissed for lack of compliance with the rules of practice in the filing of petitions, or failure to file petitions within the statutory period. As the taxpayers and their counsel continue to become more and more familiar with the rules of practice and requirements of the board, dismissals on such grounds will become increasingly fewer, and the cases will proceed to hearing and determination upon their merits. Consequently, the ratio of cases actually decided upon their merits to the total number of cases disposed of should increase with a corresponding increase in the burdens of the board.

Switchboard at the plant of the Consolidated Mining & Smelting Co., Tadanac, B. C.

Flotation of Rand Pyritic Gold Ores—I

Tests Made on Laboratory Scale to Determine Most Satisfactory Flow Sheets—Fine Mineral Particles Incased in Gangue Offer Difficulties—Economic Conditions Governed Installation of Commercial Size Plant

By H. Hardy Smith
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THE METHODS OF EXTRACTING GOLD from the banket reefs of the Witwatersrand area of the Transvaal have been in vogue for twenty years and are too well known to require detailed description. They involve coarse crushing by gravity stamps, followed by medium fine grinding in tube mills, amalgamation of the tube-mill pulp, classification of the pulp after amalgamation into sand and slime products, intermittent dewatering of the slime in settling tanks, cyanidation of the sand by leaching, and cyanidation of the slime by agitation in pachuca tanks, followed by filtration in Butters filters.

Modifications of this practice recently introduced are: replacement of amalgam tables by corduroy strakes, to catch coarse free gold and osmiridium; elimination of all gold-recovery appliances ahead of the cyanide plant, and reliance on the cyanide solution alone for the extraction of the gold from the sand and slime; and, the most recent innovation, "all-one-product" treatment in which sand leaching is dispensed with and the whole of the ore is ground fine enough to allow it to be handled satisfactorily in the agitating tanks and Butters filters. In the modern all-sliming plants stamp batteries and other forms of intermediate crushers have been eliminated and reliance has been placed on tube mills alone for the production of final pulp from the rock-breaker product. This milling system is a noteworthy advance, and is fully and ably described in a paper by Davis, Willey, and Ewing in Vol. LXXI of the *Transactions* of the A.I.M.E. The costs obtained in the modern plants with fine grinding compare favorably with those under the previous standard system of milling and extractions are improved.

The recovery of gold made by the aforementioned methods of treatment varies from about 92 to 97 per cent, the higher recovery being made mostly on ore from the central Rand area, and the lower recovery on the less tractable ores of the Far East Rand. In the generally accepted sense, no refractory ores are being treated in the field. The low recoveries are because of the presence of the gold in a finely disseminated state —a condition which is particularly pronounced when the gold is associated with the pyrite—which makes a portion of the valuable metal either entirely inaccessible to the cyanide solution, owing to its being surrounded with pyrite or gangue, or only partly accessible because of the existence of minute cracks and fissures in the inclosing medium through which the cyanide solution can act only after prolonged contact. Economical means for making the residual gold readily accessible to cyanide solution are therefore indicated, though the present standard of work is so high that little margin is left for increasing the profits by improvement in metallurgical practice. However, the tonnage treated is so large that an insignificant extra net earning per ton rapidly mounts to a considerable aggregate, which, although only a small percentage of the total revenue, yet makes it sufficient to assure that careful consideration will be given to any plan or method which shows possibilities of success.

Once the fact had been established that locked-up gold was invariably the cause of unusually high residues, finer grinding was indicated as a panacea. But it was found that the gold content of the residue was not so low as was expected from the finer grinding, in spite of the excellence of the design of the new plants and the consequent faultless mechanical operation. A theory will be advanced here to account for this discrepancy which is of especial interest in view of its bearing on the application of froth flotation to the treatment of Rand ores.

The auriferous banket of the Rand has an average content of about 2½ per cent of pyrite. The greater part of this pyrite is auriferous, and of the total gold the proportion which is contained in the pyrite is appreciable along the whole line of reef, and in the Far East Rand it represents a considerable part. Such gold as is associated with the pyrite is most difficult to extract. Hence it is desirable that the grinding effect be greater on the sulphides than on the gangue. At first thought it would appear that the "all-one-product" method of milling would accomplish this most effectively, because the higher specific gravity of the pyrite should prevent it from overflowing the classifiers until reduced to a much finer state of subdivision than the gangue. But a comparison between the pyrite in fine "all-one-product" pulp and in coarse "standard-practice" pulp indicated that something was amiss, for the difference in fineness between the pyrite portions was less than that between the gangue portions. From which it would appear that the greater specific gravity of the pyrite has little effect in the fine sizes, and to accomplish the desired comminution of the sulphides the plant must be provided with facilities for doing unnecessary work in reducing the gangue to a size finer than is required for the satisfactory recovery of the contained gold.

The unexpected behavior of the comparatively fine pyrite probably can be explained by the readiness with which pyrite comes to the surface in the flotation process. The pulp is subjected to intense agitation and aëration, and a little grease and oil, from the machinery used, is always present in mill pulp, accumulating in the closed circuits of milling water. So it is quite conceivable that the particles of fine pyrite would have as much a tendency as the pyrite to float from the classifier. Separation of the pyrite and gangue prior to the final stage of intense grinding is therefore indicated, so that the grinding effect can finally be concentrated on the pyritic portion. The fundamental soundness of this idea had been recognized for some time, and much experimenting carried out with gravity

concentrating appliances. These were not successful, because, to obtain an attractive increase in profits over those of standard practice, it was necessary for the pyrite to be separated most effectively and at the same time cheaply. The cost of the extra plant and treatment was of importance, and no system of gravity concentration was capable of making cheaply a high extraction of the pyrite, especially of the finer sizes, which were often associated with the highest gold content.

Froth flotation appeared to offer great promise of success, so investigations were commenced during 1922 in a laboratory established by a London company exploiting the flotation process. It already had been established that a high recovery of free gold could be made by flotation, and it was found that under the same conditions a high percentage of the pyrite also was extracted from Rand ores.

"ALL-FLOTATION" TREATMENT

The results from the preliminary tests indicated the possibility of applying "all-flotation" treatment. Experimental work on ores from various mines indicated the following procedure: The ore to be ground to the usual fineness by existing methods; a suitable collecting oil to be added to the tube mills; the pulp leaving the tube-mill section to be dewatered to 2½:1 and treated direct in a roughing subaëration flotation machine, to the head of which a suitable frothing oil is to be added; tailing from the flotation plant to go direct to the tailing dam; rougher concentrate to be diluted with fresh water and cleaned in a subaëration cleaning machine; tailing from the cleaning machine to be returned to the tube-mill section; clean concentrate to be dewatered, repulped with cyanide solution, lime added, and slimed in a special tube-mill circuit; slimed concentrate to be diluted to 2:1 with full-strength cyanide solution, mechanically agitated in tanks, and filtered in a pressure filter; washed filter cake to be discharged onto a special dump; and pregnant solution to be precipitated by the Merrill-Crowe process. This cyanidation process shows some divergence from standard practice. The reason for dewatering the flotation concentrate previous to cyanidation was to avoid diluting the cyanide circuit, so that a strong solution could be used without excessive loss of cyanide due to the necessity of discarding a large volume of excess barren solution. A further advantage was the avoidance of loss of gold if the discarded barren solution could not be reduced to the usual low gold content prevailing on the Rand. A Dorr thickener followed by a continuous vacuum filter was to be used for dewatering the concentrate. The slimed concentrate was to be mechanically agitated in tanks of the A—Z or Devereux type, as experiments had shown that there was danger of trouble from frothing in pachuca tanks. A pressure filter was proposed in preference to the standard Butters filter because the glutinous nature of the slimed concentrate made it unamenable to filtration in a vacuum filter. The leached concentrate was to be stacked separately because of the possibility of future profitable disposal owing to the sulphur and residual gold content, the former being upward of 40 per cent in some instances, and the latter being about 1 dwt. ($1) per ton.

Table I shows typical results of tests made to determine what improvement in extraction could be expected by employing the above method instead of the "all-one-product," direct cyanidation method on a "refractory" ore from the Far East Rand. The actual extraction of gold as bullion is seen to be practically the same in each case, notwithstanding that 95.6 per cent of the gold was recovered in the flotation concentrate and that 98.4 per cent of the gold in the concentrate was extracted in the cyanide solution. The concentrate obtained in this test was dirtier than usual because of an abnormal amount of footwall slate in the sample used. The average weight of the concentrate obtained was about 9 per cent of the original ore, and it assayed 75 dwt. per ton. On clean banket ore the proportion of concentrate was as low as 5 per cent and the gold content as high as 130 dwt. per ton.

Table I

Comparative Results of "All-Flotation" Treatment and "All-One-Product" Cyanidation

	"All Cyanidation"	"All Flotation"
Assay value of crude ore treated	7.1 dwt. per ton	7.0 dwt. per ton
Grading after grinding	4.4 per cent plus 100 mesh	4.5 per cent plus 100 mesh
Reagents used during grinding	0.2% KCN solution 0.05% CaO solution	1 lb. per ton gas coal tar
Water: solid ratio during flotation		2 : 1
Time of treatment by flotation		20 minutes roughing 8 minutes cleaning
Reagents used during flotation		0.4 lb. per ton eucalyptus oil
Weight of concentrate produced		13 per cent of crude ore
Assay value of concentrate		50 dwt. per ton
Weight of middling produced		20 per cent of crude ore
Assay value of middling		1.15 dwt. per ton
Flotation tailing: Weight		67 per cent of crude ore
Value		0.36 dwt. per ton
Recovery by flotation (from feed and tailing)		95.6 per cent
Time of agitation with KCN soln.	12 hours	15 hours (concentrate only)
Water: solids ratio and strength of solution	2 : 1 0.2 per cent KCN 0.05 per cent CaO	1.54 : 1 0.2 per cent KCN 0.05 per cent CaO
KCN consumption:		
Per ton of concentrate		4.8 lb.
Per ton of crude ore	1.8 lb.	0.65 lb.
Strength of solution after agitation	0.155 per cent KCN 0.076 per cent CaO	0.032 per cent KCN 0.012 per cent CaO
Gold precipitated from solutions	6.7 dwt. per ton of crude ore	6.4 dwt. per ton of crude ore
Cyanided residues	0.43 dwt. per ton	0.8 dwt. per ton (concentrate only)
Recovery from flotation concentrate by KCN		98.4 per cent
Gold in total final residues	0.43 dwt. per ton	0.42 dwt. per ton
Total net recovery	94.0 per cent	94.1 per cent

The comparison shown in Table I is hardly fair to the "all-flotation" method, because the residues from the cyanide test are rather lower than those obtained by similar treatment of the same ore in practice, probably because the pyrite was ground finer and cyanidation was more intense. However, the results showed that there would be little to choose between the two processes in the matter of recovery, and any substantial increase in revenue by using "all flotation" would have to come from decreased capital charges and lower working costs. In this connection it was estimated that by adopting "all flotation" in a new plant the capital cost of the cyanide section would be reduced by 80 per cent. From this saving, the cost of the flotation section and the concentrate regrinding unit would have to be deducted.

The working costs of the flotation section, treating 2,000 tons per twenty-four hours, were estimated at 24c. per ton, made up as follows:

	Cents per Ton
Reagents	14
Power	6
Labor and superintendence	3
Repairs and renewals	1
Total	24

The cost of sliming and cyaniding the concentrate was estimated at $1.20 per ton of concentrate, which, with 9 per cent of concentrate, gives 10.8c. per ton of ore treated. This increases the total operating costs

of the flotation section to 34.8c. per ton, which compares favorably with the cost of operating a standard slime cyanidation plant. The margin in favor of flotation becomes wider as the percentage of concentrate is reduced.

Influence of Gangue-Incased Gold

Even with perfect flotation conditions and practically complete recovery of all free gold and pyrite, it is not possible to reduce the gold content of the plus-100-mesh tailing below a certain definite figure, which, with the usual fineness of grinding (5 to 6 per cent plus 90 mesh) is higher than that for the same product after cyanidation. The reason for this is that there are gold particles in the coarse sand which cannot enter the flotation froth on account of gangue incasement, but which are still accessible to cyanide solution because of partial exposure or by way of cracks in the inclosing medium. This kind of loss is the bugbear of the "all-flotation" method of treating precious-metal ores, and in the metallurgy of any ore pulp in which more than a small percentage of the total precious metal particles are incased in gangue, cyanidation cannot readily be entirely discarded. Some of the ores of the Rand, after being ground to a fineness within the economic limit, have only a small proportion of gangue-incased gold, and with such ores the tests showed that "all-flotation" treatment was not outside the bounds of practicability when a new plant was to be erected. But the Rand engineers were not inclined to adopt such a radical innovation without a thorough trial on a commercial scale, and the not inconsiderable funds for such a plant were not forthcoming.

"All Flotation" With Auxiliary Sand Leaching

After extensive tests with "all-flotation" treatment, with special consideration of the gold incased in gangue, it was decided to try flotation in a different way. Instead of running the flotation tailing to waste, it was to be separated into sand and slime, and the sand cyanided, only the slime being discarded without further treatment. This plan had several features to recommend it. The difficulty with gangue-incased gold would be overcome, so that grinding just fine enough to release the pyrite would be sufficient. In all the mills on the Rand, except the modern "all-one-product" plants, the medium fine grinding necessitates that the tailing be separated into sand and slime before disposal, because stable slime dams cannot be built with slime containing much sand. Hence, if flotation were introduced at such plants the sand tanks still would have to be used, and once the sand is in the tanks the cost of cyanidation by leaching is low, so that the extraction of an extra 0.5 dwt. per ton would pay.

The scheme of treatment up to the point where the tailing leaves the flotation section would be the same as in the "all-flotation" method, except that a coarser pulp would be produced, with consequent lower grinding costs. Either one of two advantages could be expected from the use of this process on the more refractory ores of the Far East Rand. The same recovery could be obtained on a coarser pulp, or, in other words, a larger tonnage could be put through a given plant without greater loss in tailing; or a higher extraction could be obtained on the same tonnage.

In an existing plant, this method would entail the scrapping of the slime plant, it being substituted by flotation machines and a concentrate treatment section. As already mentioned, the operating cost of the flotation section would compare favorably with that of the discarded slime cyanidation plant, and the desirability of making the change would depend on whether the increased recovery would offset the capital charges on the new flotation section and leave an appreciable margin for increasing the net profits from the property. With a new plant, the flotation section could probably be built at less cost than the superseded slime plant, and any increased recovery would be clear gain.

Table II shows typical figures from laboratory tests with the above process on an ore from the Far East Rand which had yielded abnormally high residues when

Table II

Results of "All-Flotation" with Auxiliary Sand Leaching

	Weight, Per Cent	Assay Value Dwt. per Ton	Percentage of Total Gold
Ore treated	100.0	6.0	100.0
Flotation concentrate	7.5	74.5	93.0
Flotation tailing	92.5	0.45	7.0
Slime elutriated from flotation tailing	31.0	0.2	1.0
Sand from flotation tailing after elutriation of slime	61.5	0.58	6.0
Above sand after cyanidation	61.5	0.2	2.05
Gold in cyanide solution by difference	.....	.....	3.95

	Per Cent
Total extraction in concentrate and cyanide solution from leaching	97.0
Extraction of gold from flotation concentrate by sliming and cyaniding	98.5
Hence the net recovery	95.6

treated in a standard type of plant using the "all-cyanidation" process with separate sand and slime treatment. The recovery being made in the commercial plant when these tests were conducted was about 92 to 93 per cent, but higher-grade ore than that tested was being treated.

If the metallurgical difficulties, to be mentioned later, which are likely to arise in a plant embodying combined flotation and cyanidation can be avoided or overcome, the above method of treatment looks distinctly attractive, but investigations did not reach finality, on account of efforts being diverted into other channels. As with the straight "all-flotation" method, the difficulty was to get a full-scale test plant installed.

Flotation Applied to Current Residues

This obstacle became less formidable if a method could be devised for applying flotation to Rand ores without interfering with established practice, but rather as an accessory thereto, so investigations in this direction were initiated.

If gold could be extracted profitably from the residues, the installation of a flotation plant would not interfere with existing practice and a trial plant could be erected at relatively small cost. The slime residues were too low grade to make re-treatment practicable, but sand residues carried from 0.5 to 1 dwt. per ton, and thus offered possibilities of profitable scavenging treatment. Some typical results from a large number of tests on current sand residues from various mines are given in Table III. Tests Nos. 1 and 2 were made on sand residues from a plant treating a "refractory" Far East Rand ore. Considering the class of ore, the grinding was coarse at the time the samples were taken (58 per cent plus 90 mesh; 28 per cent plus 150, and 14 per cent minus 150), and the assay of 1.1 dwt. in test No. 2 was above the average, possibly on account of some disarrangement of the plant at the time. Test No. 3 was on sand from a mine treating a non-refractory ore in the same district. Tests Nos. 4, 5, and 6 were on sands from mines in the central Rand where the ores are more amenable to standard treatment.

Table III

Results of Flotation Concentration of Current Sand Residues

Test No.	Gold in Sand Residues Before Flotation, Dwt.	Flotation Concentrate Weight, Per Cent	Assay, Dwt.	Assay of Sand After Flotation, Dwt.	Recovery of Gold, Per Cent	Dwt. Recovered per Ton
1.	0.9	3.9	8.0	0.6	34.7	0.3
2.	1.1	3.5	11.5	0.68	36.6	0.42
3.	0.55	4.0	8.0	0.25	58.2	0.3
4.	0.47	3.95	6.9	0.20	57.9	0.27
5.	0.6	4.03	9.0	0.24	60.6	0.36
6.	0.58	3.0	11.0	0.25	56.9	0.33

An interesting point in connection with these results is that although the percentage recovery of gold varies widely with the different ore samples, the amount of gold recovered per ton treated is practically the same for all residues; namely, about 0.3 dwt. For this reason the application of flotation to the higher residues is not so advantageous as would at first appear. Throughout the field, the amount of gold which is associated with *free* pyrite in the residues is about the same, so abnormally high residues are due to gold, or auriferous pyrite, which is gangue-incased and neither accessible to cyanide solution nor amenable to flotation.

The disadvantage of the above method of applying flotation is that the capital charges and operating costs of the plant are a distinct addition to the expense of ore treatment, so the extra recovery made must be sufficient to cover this additional expense as well as to give an appreciable profit. An advantage of treating sand alone is that the pyrite in de-slimed sand floats readily, so that inexpensive reagents can be used and a large tonnage can be treated in a small machine, with consequent low working costs. The cost of operating a sand-flotation plant, treating 800 tons of sand per twenty-four hours, was estimated at 8c. per ton, made up as follows:

	Cents per Ton
Reagents	3.5
Power	2.0
Labor and supervision	1.0
Repairs and renewals	1.5
Total	8.0

To this amount must be added the cost of concentrate treatment, which, at $1.20 per ton and 5 per cent of concentrate, works out at 6c. per ton treated, and the cost of rehandling the residues, which was estimated at 5c. per ton. The total operating expenses of the flotation section therefore would be:

	Cents per Ton
Flotation	8.0
Concentrates treatment	6.0
Re-handling residues	5.0
Total	19.0

Taking residues from which 0.3 dwt. per ton could be recovered by flotation, and an extraction of 85 per cent of this by cyanidation of the concentrate, which is what experiments showed could be expected under good conditions, the net additional recovery is 25c. per ton, which leaves 6c. working profit. After allowing for capital charges and royalty, this is hardly attractive.

Sand Residues Used for Stope Filling

If the working costs could be diminished by eliminating the rehandling charges, the method would become decidedly attractive, so means for doing this were investigated.

The practice of supporting mine workings by filling old stopes with sand residues is in vogue at a number of mines on the Rand. Sand used for filling is transported to the stopes by water, and the cost of pulping and handling is necessarily charged to mining costs. So that, at these mines, the rehandling charge could be eliminated by interposing the flotation machine between the sand tanks and the stopes. This plan looked promising, but the fact that the sand-filling system operates intermittently and the flotation section would need to do likewise militated against the successful application of the process in this manner if standard apparatus were used. A type of machine, to be described later, which was more suitable for intermittent operation than a standard machine, was designed by me with the idea of overcoming the difficulty, and had the installation of this apparatus been made, it is probable that several plants would now be in operation at mines where sand filling is practiced. Instead of this, the idea of treating sand residues was abandoned and efforts were directed toward the removal of pyrite from the sand before subjecting it to cyanidation.

Rehandling Charges Eliminated

By applying flotation to the sand leaving the desliming section of the mill (known as "original sand") the rehandling charges inseparable from the treatment of sand residues, except in conjunction with sand filling operations, could be eliminated. When this plan of attack was decided upon, samples of "original sand" were obtained from various mines and tested by flotation followed by cyanidation.

Table IV

Results of Flotation Concentration of "Original" Sand

Test No.	Assay of Original Sand, Dwt.	Flotation — Concentrate Weight, Per Cent	Flotation — Concentrate Assay, Dwt. per Ton	Flotation Tailing, Dwt. per Ton	Sand Residues After Cyanidation, Dwt. per Ton	Extractions — In Flotation Concentrate, Per Cent	Extractions — In KCN Solution, Per Cent	Extractions — Total Per Cent
1.	12.0	3.72	290.0	1.4	0.45	88.8	7.6	96.4
2.	11.5	3.76	250.0	2.2	0.55	81.7	13.6	95.3
3.	9.8	3.49	224.0	2.1	0.58	79.7	14.5	94.2
4.	3.8	3.43	70.7	1.5	0.28	63.8	29.0	92.8
5.	4.0	4.3	74.0	0.86	0.26	79.5	14.5	94.2
6.	3.6	2.73	92.6	1.2	0.36	70.0	20.3	90.3
7.	3.3	3.78	63.2	0.92	0.25	72.5	20.2	92.7

Some typical results are given in Table IV. Tests Nos. 1, 2, and 3 were made on original sands from a plant treating a Far East Rand refractory ore by cyanidation without preliminary amalgamation or blanketing. The high assay of the concentrate is due to the presence of free gold. Test No. 4 was on sand from a mine in the same district treating a non-refractory ore by the standard method of amalgamation and cyanidation, and tests Nos. 5, 6, and 7 were on sands from mills using standard treatment in the central Rand area. In tests Nos. 2, 3, and 6 the extraction of the free pyrite in the sands was incomplete; hence the poorer gold recoveries. It was discovered early in the tests that to show an attractive decrease in final residue assays the extraction of free pyrite from the sand had to be practically complete, and some of the causes of the difficulty of getting this complete extraction will be dealt with in a succeeding article.

Cyanidation experiments on the concentrates produced in the flotation tests of Table IV showed that a recovery of 98.5 per cent of the contained gold could be made under suitable conditions.

(*To be concluded in the Aug. 7 issue*) . . . . .

Smelting Iron in Angola

Few Opportunities Offered for American Metallurgists, as Furnace Ills Are Cured by Native Medicine

By James R. Evans
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SMELTING OF IRON ORES as practiced by the natives of the Luchaze tribe, in Angola, Portuguese East Africa, is hardly an inspiration for a technical article, but a short description of the methods used and the conditions under which iron is made will, I think, nevertheless be interesting.

The Luchazes are the real iron workers of this region and supply the other natives with hoes, knives, spears,

Fig. 1—Iron furnace, covered to protect from sun and rain

and axes. Most of their tax money is derived from the sale of these articles, and it was my privilege to see them at the height of the smelting season, when there was a rush on to make enough articles to sell in order to pay their hut taxes. At this time everyone joins in the work—men, women, and children. Each year they foolishly do this same thing, and as a consequence there is always a buyers' market; they receive only about 50 per cent of what they would get if they sold their goods at other times—but, native and child-like, they do not think ahead, and they never do anything unless it must be done.

Ore Treated Is Self-Fluxing

The ore treated is an impure limonite, or bog iron ore, and is mined on one of the near-by creeks. There is much of this sort of ore throughout all tropical Africa. The ore, on account of its impurities, is self-fluxing and is mined usually by the women and carried in baskets to the smelter. There it is broken into the proper size, from $\frac{3}{8}$ to 1 in., for smelting. Portions of partly smelted ore from the previous day's charge are also picked out and returned to the furnace.

The charcoal used is of good quality, though wastefully made. The material used is a hardwood tree which is cut and piled on the ground. A fire is made, and when the whole is a mass of coals water is thrown on and the charcoal is recovered. The wood is never burned in a kiln, and the natives refused to try to make a better burning when it was suggested to them.

As will be seen from photographs Nos. 1 and 2, the furnace is not large. It is built of clay, stands about 4 ft. high, is about 4 ft. in diameter, and practically round, the back being almost straight and flat. A lip is built on top and over the back of the furnace, to give more storage space for iron ore and charcoal. As will be noted, the top of the furnace is not flat, but inclined toward the mouth. This lip, being weak, is sometimes supported by sticks. At the back of the furnace and below the surface of the ground is dug a ditch, and it is there that the smelted material, both slag and iron, as well as the unburned charcoal, is removed after the smelt, or run. The opening is closed by a slab of earthy substance cut from one of the ant hills which are numerous in this region. This slab is made with a small hole, through which some gases escape, and to this hole the smelter-man comes from time to time to note how his furnace is operating. At the bottom of the front of the furnace at ground level is left a hole through which the blast of air is forced and which is also used as a peephole by the smelter-man. In front of the hole is placed a tuyère made of baked clay.

Blast Produced by Goat-Skin Bellows

The blast is produced by bellows made from wood and goat skin, of a shape shown in Fig. 3. There are two complete bellows for each furnace, and the handles are manipulated by boys or young men. Grasping a stick in each hand they begin their work, and the rapidity and skill with which they manipulate their arms and the length of time they can keep it up is extraordinary. The stem or end of the bellows is placed near the end

Fig. 2—Native furnace, with sticks supporting the lip. Men are operating the bellows and adding the charge

of the baked clay tuyère, but not exactly against it, an open space being left so that when the bellows draw in air, it is not hot gas from the furnace, which would quickly destroy the skin of the bellows, but cool air from outside.

The furnace is charged first by bedding down with

Fig. 3—A young smelter-man with two pairs of bellows. Wood for charcoal in background. In the foreground is a basket of iron ore, to say nothing of the photographer's shadow

charcoal, which is piled until it reaches the tuyère or blast opening; a fire is started and more charcoal is added at the top, or charging door. When the fire is burning satisfactorily, the bellows are operated, and the blast is then kept going continuously until the smelt is finished. This usually takes from ten to fourteen hours, so work is begun fairly early in the day, and I have seen it carried on until 9 in the evening. As the fire burns, the heat spreads, and soon the charcoal is a red mass; gas escapes from the top and from the back, and the temperature is tested by the furnaceman, who drops in certain unknown native concoctions, leaves, and other materials. The gas at the back is lit by a burning taper or twig, more charcoal is added at the top as the column begins to burn down, and when the furnace is hot enough the ore is added, little by little and always mixed with the charcoal. As the ore nears the smelting zone, one notes through the tuyère opening the molten iron beginning to drop into the charcoal below, and with this the molten slag also drops to the bottom.

"Medicine" Man Helps

The operation of smelting is kept up all day or until a certain amount of iron ore has been smelted. From time to time the furnace-man, who is usually an old native, both in years and experience, throws some leaves, or medicine, on top of the charge; this medicine, by the way, is a secret, and is only known to a select few.

After the daily charge is smelted, the back of the furnace is broken down and the burning charcoal pulled out by light green poles. The "bloom" or melt is finally exposed and pulled out for cooling and inspection: it is a mass of charcoal, iron, and slag, but the smelter-man inspects it carefully, knocking off a corner here and there and commenting on the run. This piece weighs from 20 to 35 kilos, and is now heated in an open charcoal furnace, and pounded until there is little else left but a mass of soft iron. This is then heated, cut up, and fashioned into the various articles of commerce such as hoes, knives, axes, and spears.

Blacksmithing Crude but Efficient

The blacksmithing tools are crude—rough tongs and a blunt piece of iron imbedded in a tree trunk serve as an anvil. For a hammer, another blunt piece of iron, grasped in the hand, is used, yet despite the lack of good tools the work turned out is exceptionally good, and the tools are very serviceable, though somewhat soft. Some of the repairs made by a native blacksmith —for example, on an old flint-lock musket—are cleverly done, and many white men have found a native smith very useful.

The native art of smelting is handed down from father to son, and for that reason one sees a small boy working with his father, whereas a boy of the same age in a civilized country would be in school. But in Africa it is different, and all native children, from the time they can walk, are made to work.

Mineral Production of Tunisia Less in 1925

All of the principal minerals produced in Tunisia registered declines in production in 1925, apparently a result of discontinuance of the use of military prisoners as mine laborers—although the operating companies endeavored to replace this prison labor with native workers, according to *Commerce Reports* of July 12. An adequate force of native laborers was not available, however. There has, consequently, been a considerable importation of foreign labor and an extension of the use of machinery. The larger companies have undertaken long-time programs of electrification and are increasing the capacities of their power plants. These improvements have been made possible by the large profits for the year. The smaller companies, without reserves, have not been able to make these mechanical installations and are still suffering from the labor shortage. In spite of the profits made by the more important companies during the year, the depreciation of French currency has moved them to increase their amortization funds and to set aside large sums for emergency reserves.

Among the more important metals produced in Tunisia, lead ore declined from 38,923 metric tons in 1924 to 36,863 in 1925; zinc ore, from 19,997 to 18,656 tons; copper ore, from 163 to 75 tons; and manganese ore, from 2,820 to 1,802 tons.

A summary of conditions, appearing in the *Journal Officiel*, follows:

"In the domestic economy of Tunisia the mining industry constitutes a factor of prosperity of the greatest importance. The undersoil of the regency contains large quantities of phosphates of chalk, iron ore, lead and zinc, the exploitation of which is carried on very actively and has occasioned the creation of mining centers with the most modern and perfected equipment.

"In 1923 the mineral products extracted from the ground and shipped to France and abroad, where they constituted a valuable exchange material, amounted to 3,250,000 tons, valued at 210,000,000 francs f.o.b. Tunisian ports."

Discussion

Selective or Differential

THE EDITOR:

Sir—In the issue of the *Engineering and Mining Journal-Press* of April 3, 1926, an editorial appears under the title "Selective and Differential Flotation." In it the suggestion was made that your readers present their views. To date I have not noted any discussion of the subject.

"Differential" as applied to flotation has never appealed to me as a precise or appropriate word with which to designate this metallurgical process. Referring to Webster we find: "Differential, *a*, 1, Creating a difference; discriminating; special. 2 (Mech.), (a) Differing in amount or in the producing force. (b) Intended to produce or indicate difference of motion or effect. . . . An increment, usually an indefinitely small one, given to a variable quantity."

To the engineer "differential" at once directs the mind to mechanics or mathematics, neither of which enters into the action of a reagent which chooses this mineral or another which chooses that mineral.

As to "preferential" and "selective," the former is passive in its significance and only indifferently expressive of the actual results accomplished in the process; the latter, "selective," is positive, stating definitely that it chooses a mineral (or minerals) and floats them, in the flotation process.

"Flotation" amply covers the process or the treatment of an ore of one or more minerals making a concentrate. In the use of the flotation process wherein a mineral containing the essential value of the ore is floated and all other susceptible minerals are depressed, or wherein one commercial mineral is separated and its separation followed by that of another commercial mineral, "selective" is definitely and amply distinguishing without multiplying words in order to express the same accomplishment. L. S. ROPES.

Helena, Mont.

Chemical Experiments and Cookstoves

THE EDITOR:

Sir—In your sarcastic criticism on page 3 of your issue of July 3, I believe you are not being strictly fair to Monsieur Joltivet Castelot, president of the Alchemical Society of France. Why not try the simple experiment yourself, even in a cookstove as suggested, before such a criticism is made?

You will have no trouble in obtaining the right ingredients, provided you go to some one who knows more technical French than the translator of the news dispatch. In that way you will learn that *acide azotique* is one of the names given in French to nitric acid, and that *trisulfure d'arsenic* and *pentasulfure d'Antimoine* stand for arsenic trisulphide and antimony pentasulphide.

You shall have to admit, then, that these substances are perfectly well-defined chemical compounds, and therefore that no criticism is due until the cookstove experiment is performed. J. ZAMBRANO.

Agujita, Coahuila, Mexico.

Politics in the Mining Game

THE EDITOR:

Sir—In your editorial, "Help From the Government," in your June 26 issue, it is stated: "Why, it was pertinently asked at the recent meeting of the National Coal Association in Chicago, does Congress yearn to fix a minimum price for farm products and a maximum price for coal?" You reply: "The answer does not lie in economics but in politics. The farmers are powerful voters, the miners numerically unimportant and politically insignificant."

Yes, that is the reason, but one may ask how is it possible and why is it necessary for Congress to cater to any set of interests at the expense of the public? The answer lies in a wrong conception of what the function of government is. In my opinion the whole idea and practice of modern representative government is fundamentally unsound. John Stuart Mill says that the function of a representative body is to indicate *wants*. That is the generally accepted theory and practice today. At the bottom it is a question of whether it is the business of government to supply wants—to do everything for everybody—or whether it is the business of government just to administer justice and settle grievances.

It would be interesting to know just how the idea and practice originated that the business of government was to do everything for everybody. Why the business of government was to do anything for anybody other than protect the individual in his rights? The idea and practice logically follows from the application of the theory or doctrine of majority rule. By majority rule the whole power of government is placed in the hands of a majority. Where it is applied to any sort of a delegate system it actually makes for minority rule; that is, it gives a majority of a majority rule. That it to say, majority voting does this. The majority or any part possessing this power naturally exercises it in furthering their own interest at the expense of others. They don't, nor should it be expected that they would, exercise it in administering justice. The idea and theory of representative government has been made to conform to a practice made necessary by the doctrine of majority rule. Our whole representative system is inherent in majority rule.

It is because majority rule tends to work out this way that we hear so much preaching on the subject of government; if such a system is to work we must in some way persuade those in power not to abuse their

power. Because majority rule makes it possible for some people to supply their wants at the expense of others, Congress becomes nothing but a want-supplying organization—every one trying to feather his nest at the expense of the public—and not an organization for administering justice. In plain English: to make want indicating and want supplying a function of government is to elevate graft to a principle of government. Representative government, as we know it today, is nothing more or less than a system of organized graft. The man who proposed putting a nursing bottle on the dome of the Capitol in Washington and on all the various state houses had the right idea. The Socialist, to correct the privilege in graft, would make it universal—the government would do everything for everybody and nobody would do anything for himself. In all essentials our present government is no different from what the socialists advocate.

Some of your readers are very much opposed to the *Engineering and Mining Journal* devoting space to this semi-political stuff. It seems to me almost impossible for men interested in mining to avoid paying attention to politics when it is possible to increase profits by playing the political game, and when it is possible for the other fellow to increase his profits at your expense. Playing the political game—it is necessary to play it—tends to destroy efficient mining. Too much reliance is placed on the political graft to make profits and not enough on improving mining methods. It will eventually throw the control of mining into the hands of those who are best at political grafting. The doctrine of majority rule is the greatest of all political superstitions, and not until it is generally realized that it is neither democratic or just will mining or any other industry be free from the necessity of having to play the political game. Today politics is really part of the mining game, and that in more ways than one. WILLIAM CROCKER.

Prescott, Ariz.

Bentonite in South Dakota

THE EDITOR:

Sir—I was interested in an article printed in your issue of May 22, 1926, written by John Melhase, geologist for the Southern Pacific Co., under the caption "Mining Bentonite in California." Since I am one of the directors of the Belle Fourche Bentonite Products Co., you may feel justified in printing the following brief outline of the bentonite fields of this vicinity, which may interest some of your readers:

The Belle Fourche company holds 154 full mining claims of 20 acres each, 16 of which are located upon an 800-acre tract of deeded land recently purchased by the company, making a total of 3,500 acres, containing a large quantity of high-grade bentonite, much of it lying at the grass roots and underlain by a hard and almost perfectly smooth rock floor. The mineral is estimated to average over 3½ ft. in depth over approximately the entire tract. Over approximately 500 acres there is no overburden whatever. The tract is situated within one and one-half miles of the terminus of the Black Hills branch of the Chicago & Northwestern Railway and three miles from the city of Belle Fourche, Butte County, S. D. This company was incorporated under the mining laws of the State of South Dakota on March 15, 1923, but production has been slow because of the fact that the uses of bentonite have not as yet become widely known.

It has been estimated by an engineer that this tract contains approximately 14,000,000 tons of a high grade of bentonite that contains no foreign or objectionable substance. A government analysis is as follows: SiO_2, 60.04 per cent; Al_2O_3, 23.26; Fe_2O_3, 3.92; TiO_2, 0.12; CaO, 0.59; MgO, 2.19; K_2O, 0.37; Na_2O, 4.35; and H_2O, 4.35. RUSH O. FELLOWS.

Belle Fourche, S. D.

Genesis of Chilean Nitrate

THE EDITOR:

Sir—Referring to an article entitled "Genesis of Chilean Nitrate" that appeared in the issue of the *Engineering and Mining Journal-Press* of May 29, notable progress has been made in knowledge of the nature of volcanic gases and sublimates since formulation of the earlier and purely speculative theories concerning primary source of the nitrate of the Chilean desert, and today few will seriously question the probable igneous origin of the nitrate and associated salts —with the possible exception of the iodate; but the suggestion of genetic relationship to Andean vulcanism will meet with no favor among those who are familiar with the geology of the region.

The dominant physical features of northern Chile are the Humboldt Current, the Coast Range, the Central Valley, and the Western Cordillera of the Andes. The Coast Range is a chain of domed and uplifted mountains, averaging about 4,000 ft. in elevation, that face the Pacific with a continuous fault-scarp and slope gently eastward to the Central Valley. The Central Valley is not of synclinal structure, but is bounded on the east and west by normal faults that roughly parallel the coast and determine a succession of graben of unequal depression that form basins of inclosed drainage. It is clearly defined opposite Iquique, less apparent at Antofagasta, and merges into the piedmont of the Andes in the Taltal district. The Cordillera presents a line of volcanic peaks bordering the heights of a plateau that rises abruptly from the Central Valley in the north, and by progressively easier stages to the southward. This northern portion of Chile, known as the Desert of Atacama, lies between two rain barriers—the cold Humboldt Current and the high wall of the Cordillera; and it is desert in full sense of the term.

The Coast Range is composed of interstratified Mesozoic sedimentary and volcanic rocks that are folded and faulted, and intruded by outliers of the granitic batholith of the Andes. These rocks also underlie and outcrop in a large part of the Central Valley and flank and underlie the Cordillera. The volcanics of this group issued from vents formed in the line of crustal weakness that subsequently developed the great fault and foredeep of the Chilean coast.

The nitrate deposits occur in the Central Valley, as discontinuous beds of variable extent. Usually beneath a light detrital overburden, they occupy alike minor basins, slopes, flats, and even the tops of low hills; but their distribution is notably confined to areas that are underlain and intersected by volcanic strata of Jurassic age (the Lias of Steinmann), except where favorable conditions have induced migration to lower-lying sites. Extensive beds of tuff are characteristic of this series, and these offer an immediate and presumably adequate source of the varied assortment of chlorides, sulphates, nitrates, and borates of sodium, potassium, calcium, and

magnesium that compose the deposits. Localization and concentration are partly due to migration, but in a greater degree result from a more thorough impregnation of certain of the tuffs with fumarolic products.

Late-Tertiary, Pleistocene, or Recent volcanics have not been recognized in close association with the deposits, a fact that rather definitely disposes of any genetic theory involving the presence of tuffs of Cordilleran origin. Fragments of chert or flint amid the surface detritus of the *pampa* have weathered out of limestones that are interbedded with the Mesozoic volcanic rocks of the province; and assertion of their igneous birth and aërial flight from distant Andean craters savors of that invocation of the black art with which the proponents of earlier theories are charged by the author.

Another hypothesis that enjoys current favor attributes formation of the deposits to desert evaporation of saline waters that are supposed to have seeped from the Cordillera and risen in the *pampa*; but the graben structure of the Central Valley is opposed to such underground circulation, and general vertical distribution of the salts in reverse order of solubility clearly proves deposition by downward-moving solution. Moreover, the *salares* of the lower depressions of the Central Valley contain hardly more than traces of nitrate.

In answer to the time-honored argument of casual observers that the scant moisture of the *pampa* is insufficient to have actuated erosion and nitrate-concentration, it may be said that although the Desert of Atacama is undoubtedly one of the most arid spots on the earth, still it is no exception to the rule that all desert regions are subject to the sudden precipitation of rain in unusual quantity at irregular intervals. Torrential rains and floods in the Pampa of Tamarugal have been recorded in the years 1819, 1823, 1852, 1859, 1878, 1884, 1903, and 1911. In 1911 so heavy was the rainfall that railway service was suspended, the *salitreras* were paralyzed, large quantities of nitrate were lost, and the towns of Antofagasta, Iquique, Pisagua, Pozo Almonte, and Huara were inundated. The last occurrence of heavy rains, in the spring of 1925, was marked by reversal of the current that washes the coast, the cold, northward-flowing Humboldt Current being supplanted by a warm stream that flowed southward. It is probable that this phenomena, although previously unnoted or at least unrecorded, is the immediate cause of all periods of heavy rainfall on the desert.

During ordinary years, the frequent fogs of the *pampa*—of nightly occurrence in winter and sometimes developing into light showers—supply sufficient moisture to effect the solution of deliquescent salts, which is followed by granular rock-disintegration through recrystallization in capillary openings under influence of the dry heat of day. The heavier rains and cloudbursts of exceptional seasons accomplish concentration of the less soluble salts, further erosion, and transportation of the coarser débris that has been left by the constant high winds that sweep the valley.

It must be admitted, however, that the progress of desert erosion is now infinitely slow; but it does not follow that it was ever thus, nor that the nitrate was amassed under prevalent conditions of extreme aridity. The Andean realm is young: tilted lake-shore lines of the *altaplanicie* indicate that the mountains attained present height since the Pleistocene, and the forces of diastrophism are still active in Chile, where a record of recent uplift is legible in the elevated strandlines of the coast. Consequent climatic change is inevitable.

Furthermore, direct evidence of a more humid climate in very recent times is found at Pozo Almonte and Matilla, in the Pampa of Tamarugal, and in the southern desert of Atacama in form of buried fragments of *tamarugos* and *algarrobas*, denoting a former woodland growth of drought-resisting species that has now entirely disappeared. History records the existence of a forest of *algarrobas* no longer than seventy-five years ago, in the vicinity of the village of Tarapaca where desert conditions now rule; and old inhabitants affirm an appreciable increase in extent of the *salares* that lie in the central depressions of the valley.

The foregoing appears to furnish satisfactory ground for assuming that the past witnessed a delicate balance of precipitation that provided a sufficiency for purposes of erosion and nitrate concentration, and avoided a surplus that would have dissipated the deposits.

Chile has no world monopoly of bromine production. On the contrary, only occasional traces of that substance are found in the mother-liquor of the nitrate; but iodine is present in such quantity as to constitute a valuable byproduct of the industry.

A possible source of the iodine is intimated by the profuse development of halides in the supergene orebodies of silver veins that cut the Jurassic sedimentaries of the Coast Range. The absence of halogens in the hydrogen ores signifies introduction from without during process of oxidation, either as cyclic salts or as derivatives of the inclosing limestones, some of which are sandy, and dark with impurities. The presence of iodine greatly in excess of its natural proportion to chlorine and bromine in sea water, and wide expansion of veins, by replacement, in the oxidized zone, seem to favor the latter supposition. The formations associated with the silver veins outcrop within the nitrate province, and, assuming inclusions of marine algal remains, it may be that the small and volatile bromine content escaped during the reactions incident to weathering, whereas the iodate lingered until dissolved by nitrate-bearing solution and eventually deposited in the *caliche* beds.

Incidentally, it may be remarked that the breached craters of the Central Andes are generally recessed on the southern or shady side, implying truncation by the erosive action of ice caps and melting-snow water rather than by explosive force. Also that mud flows mark no particular phase of vulcanism, but are secondary phenomena, of the order of landslides, which occur whenever sufficient water enters steeply inclined beds of unconsolidated tuff. Mount Shasta, presumably inactive since the Pleistocene, is even now staging a mud flow of spectacular proportions.

A three years' residence in northern Chile afforded me opportunity for leisurely study of the Antofagasta deposits, which was supplemented by visits to the Iquique and Taltal *pampas*, and conceptions then formed have persisted; but it is realized that any present explanation of the origin of the nitrate must be regarded as essentially conjectural, and that final solution of the problem must await the results of much more extensive and detailed field and laboratory work than yet has been undertaken.

ROBERT HAWXHURST, JR.

San Francisco, Calif.

News of the Week

The Mining News given in ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

FINANCING of the Silesian-American Corporation, organized to control the Giesche mining enterprises in Germany, has been completed. The Anaconda Copper Mining Co. receives a majority of the voting stock in exchange for its services as manager.

Further expansion in output is planned for the coming half year by the Consolidated Mining & Smelting Co. of Canada.

Estimates of ore shipments from the Lake Superior iron districts exceed the 54,000,000 tons that moved last year.

A second lead-zinc concentrator is to be erected on Catalina Island by the William Wrigley mining interests.

Plans for the reorganization of the Bureau of Mines have been announced by Scott Turner, Director.

Impetus to mining for lead and zinc in Korea has been given by the higher prices for these metals.

Electrification of the Sicilian sulphur mines, at cost of $1,400,000, is to be undertaken at once.

A fire on July 19 destroyed the concentrator of the Standard Silver-Lead Co., Silverton, B. C.

Operation of its Granite Mountain and Speculator properties by leasing methods is planned by the North Butte Mining Co.

Silver production from Tonopah, Nev., showed a material improvement in June as compared with May.

Anaconda Forms New Company to Hold Giesche Control

Puts No Money Into Enterprise—Gets Stock for Services as Manager—New Treatment Planned for Ores

THE Silesian-American Corporation has been formed under the laws of Delaware, with Cornelius F. Kelley, president of the Anaconda Copper Mining Co., as president, to acquire from Georg von Giesche's Heirs Mining Co. a German corporation, all of the capital stock of the Giesche company; with $6,000,000 of the German company's sinking-fund mortgage bonds. Arrangements for financing the acquisition are being made by a syndicate headed by W. A. Harriman & Co., Inc., and Lee, Higginson & Co. The Anaconda company will own a majority stock interest in the Silesian holding company, which will control the Silesian-American Corporation.

Properties of the Giesche concession include proved zinc-ore reserves which, according to estimates of Anaconda engineers, are sufficient, on the basis of 50,000 metric tons' annual production, to supply the company for about twenty years. The company also has large coal deposits. It owns large concentrating, smelting, and refining plants for the treatment and production of zinc, lead, and silver; zinc and lead rolling mills, sulphuric acid and other by-product factories, as well as some 1,400 workingmen's homes and landed estates of over 19,000 acres, of which 10,000 acres are forest land.

The directorate of the Silesian-American Corporation will consist of John D. Ryan, W. Averell Harriman, Cornelius F. Kelley, George H. Walker, and three members to be appointed by the Giesche interests.

Capitalization of the Silesian-American Corporation will consist of $12,000,000 7 per cent non-cumulative preferred stock, par $100, authorized and issued, and 200,000 shares of no par common stock, in addition to the $15,000,000 of bonds. Control of the new company will remain with Anaconda Copper Mining Co. and the W. A. Harriman interests.

Anaconda puts up no money in the financing of the Silesian-American Corporation but receives its stock in recompense for its management of the property. As a result of the deal the Anaconda Copper Mining Co. will control about one-sixth the zinc output of the world.

As the result of exhaustive tests by Anaconda engineers upon the Silesian ores, Anaconda plans to substitute for the present mining and metallurgical methods the latest American treatment methods. The Silesian ores consist of oxide and sulphide ores. In treating the oxidized ores it is proposed to volatilize the lead and zinc into a high-grade fume. This fume will then be treated by the electrolytic process developed by Anaconda at its Great Falls zinc plant, which yields an electrolytic zinc of high purity. Introduction of these improvements should lower operating costs appreciably.

Standard Silver-Lead Mill, Silverton, B. C., Burns

The Standard Silver-Lead Mining Co.'s mill at Silverton, B. C., was destroyed by fire on July 19. The fire is believed to have originated inside the mill, which only recently had resumed operations. It is estimated that the loss will total $150,000. The Standard mine, which has returned to its owners $2,700,000 in dividends, was turned over to the hands of lessees in 1918, under the belief that the property was worked out for big scale operations, and since then the company has been spending the interest of some $400,000, which was not disbursed, in searching for another property in which to invest this sum. About three years ago it acquired a controlling interest in Slocan Silver Mines, which owns the McAllister mine, at Three Forks, and has successfully developed the mine at depth. It is supposed that lessees were operating the mill, as has been their custom, when it was burned.

Kirkland Rand Exploring on 800-Ft. Level

The shaft on the Kirkland Rand, Kirkland Lake, Ontario, is now down to a depth of 840 ft., and lateral work has been done at five levels, on all of which some commercial ore occurs. Crosscutting operations are being conducted at the 800-ft. level, which are expected to reach a favorable horizon. It is understood that if present work on the 800-ft. level can be connected up with the veins that were found on the 500-ft. level, plans may be made for a mill to replace the one destroyed by fire last November.

Panoramic view of the Sullivan flotation concentrator

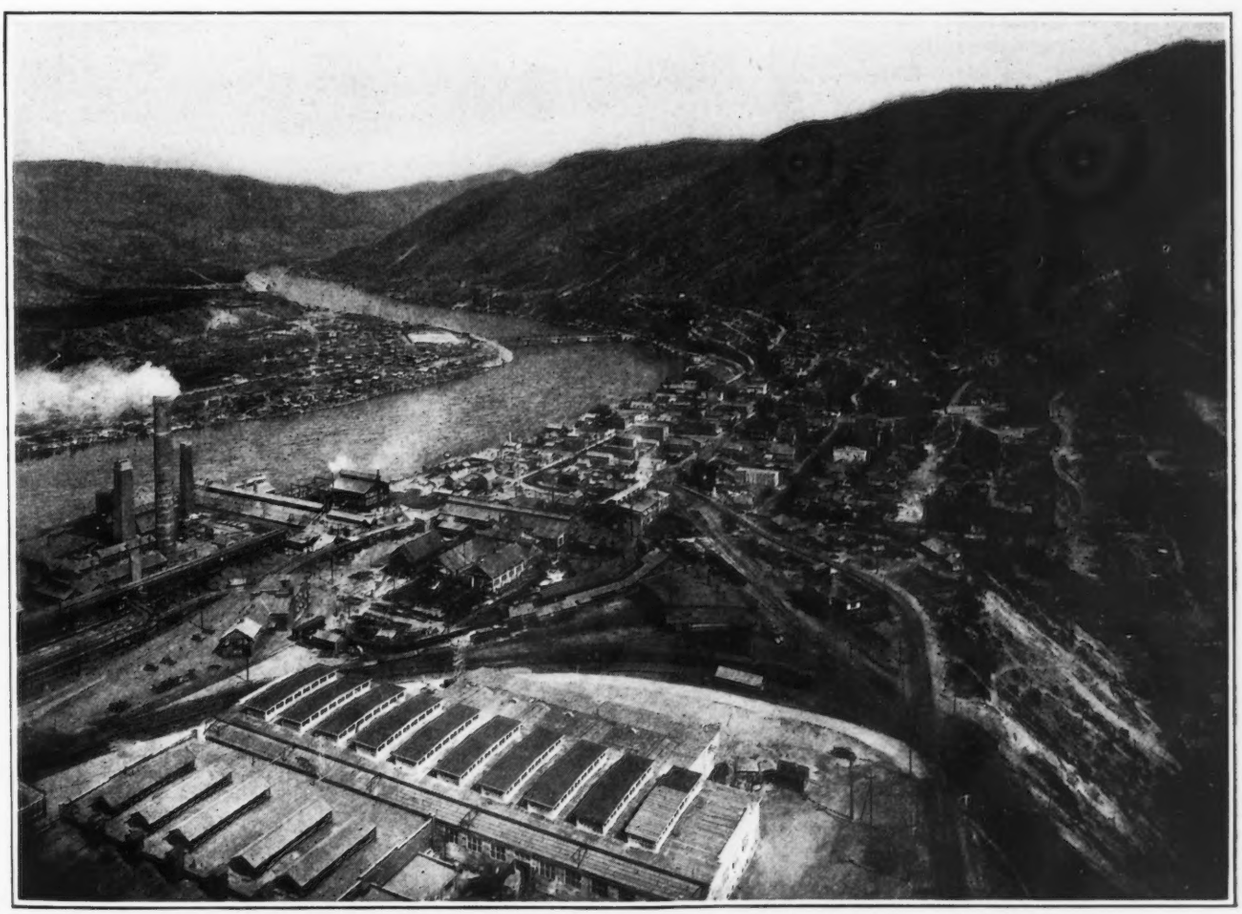
Consolidated M. & S. Plans Further Expansion

Zinc Concentrate Goes to Europe—Work Resumed at St. Eugene Concentrator—New Unit at Sullivan Mill Nears Completion

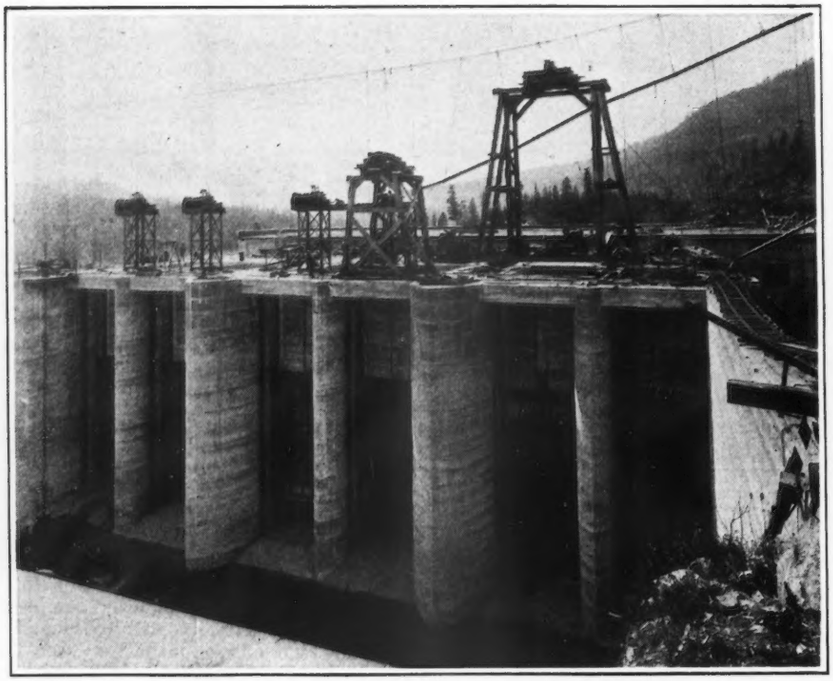
ALTHOUGH the first half of 1926 established a new record for production at the Trail plant of the Consolidated Mining & Smelting Co., in British Columbia, a still further expansion is confidently expected in the next few months. The intake of the Trail plant for the first six months of 1926 was 274,518 tons of ore and concentrates, compared with 377,890 tons for the whole of 1925. Only recently the company has put in operation its new 500-ton concentrator at the St. Eugene mine, at Moyie, and concentrate from this source is now going to Trail. Some time in August the new 1,000-ton unit of the Sullivan mill—now rated at 3,000 tons per day—will go into commission. It is said that large quantities of ore already broken in the Sullivan mine have accumulated in the stopes and the starting of the new unit will make it possible for the company to relieve this congestion.

Some months ago the addition to the electrolytic zinc plant was completed, but the capacity is still too small to handle the entire output of zinc concentrate, and accordingly a contract has been entered into providing for the shipment of 15,000 tons of this product to Europe. Increasingly large receipts of custom ore and concentrates have added to the surplus.

Power for the zinc plant as well as other departments at Trail is supplied by hydro-electric plants of the West Kootenay Power & Light Co., a subsidiary of the Consolidated Mining &



Trail and the Columbia River as viewed from the "Big" Stack of the Consolidated Smelter



Smelting Co. The total requirements are about 52,000 hp. and a new dam and generating plant has been completed recently.

The production of the Trail plant for 1925 was in round numbers 236,000,000 lb. of lead, 98,000,000 lb. of zinc, and 4,700,000 oz. of silver. The annual rate based on the first quarter of 1926 was 245,000,000 lb. of lead, 114,000,000 lb. of zinc, and 7,000,000 lb. of silver. It seems certain, however, that these figures will be exceeded by the actual returns.

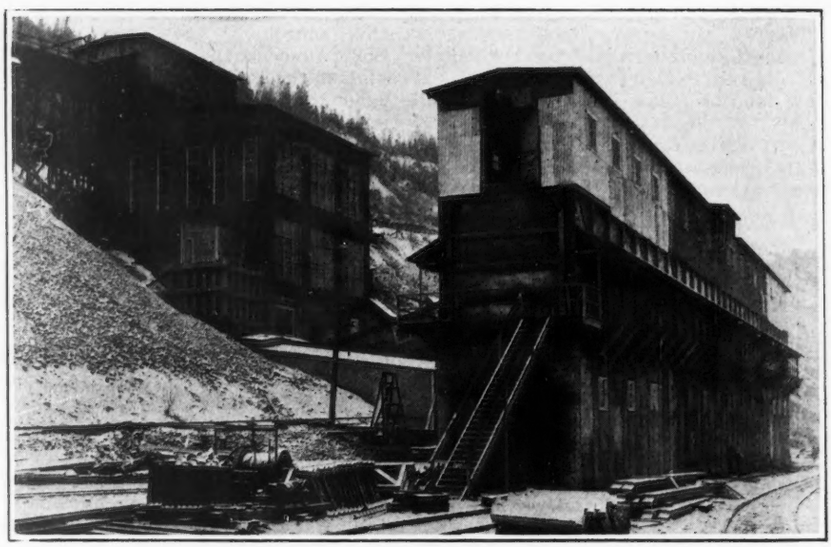
After making deductions for depletion, depreciation, contingent account, and taxes on the basis of last year's statement, and after also deducting $677,144.08 for additions to property through profit and loss, the estimated profits for the first six months of 1926 are $5,638,237.64. Computed in the same way, the profits for the first six months of 1925 were $3,960,763.65, after deducting $1,327,723.96 for additions to property through profit and loss.

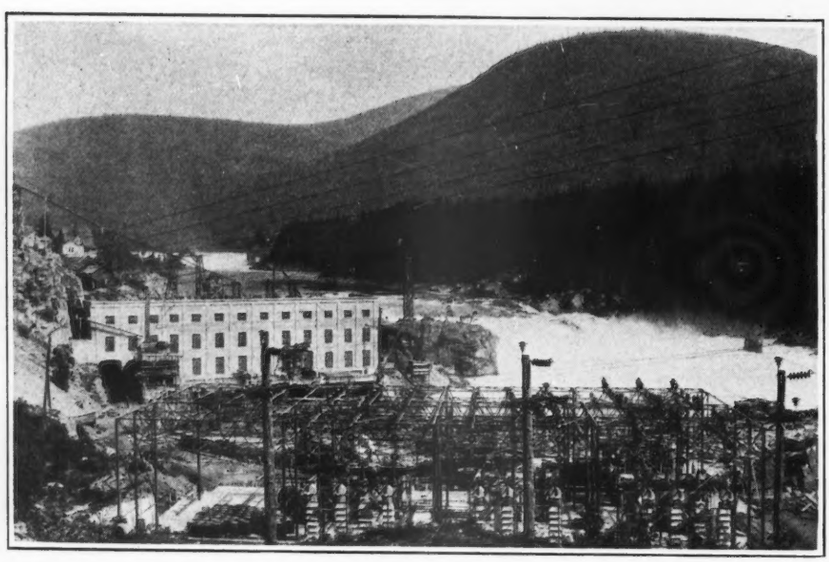
The personnel of the chief officials of the technical staff at Trail is as follows: S. G. Blaylock, general manager; W. M. Archibald, mines manager; R. W. Diamond, superintendent of concentration; James Buchanan, superintendent of the smelter; B. A. Stimmel, superintendent of zinc plant; J. J. Fingland, superintendent of refineries; G. F. Chapman, mechanical superintendent; E. M. Stiles, chief engineer; F. E. Lee, chief of research.

The accompanying photographs showing views around the reduction plant as well as the new hydro-electric development are published through the courtesy of Mr. Blaylock.

Parts of the Consolidated M. & S. Enterprise

Above—Dam at Bonnington Falls, where power for the Trail plants is generated. Right—Crushing plant and ore bins at the Sullivan mine. Below—General view of the power house and transformer stations at Bonnington Falls. The West Kootenay Power & Light Co. is a subsidiary of the Consolidated Mining & Smelting Co.





Comstock Merger Output $173,115

The Comstock Merger Mines, Inc., operating near Virginia City, Nev., on the central and southern portion of the Comstock Lode, milled 36,200 tons of ore in June which averaged $4.95 per ton. Bullion produced was valued at $173,115. This is slightly below May production figures but is normal for this company.

Kirkland Lake Mines All Sinking to Lower Levels

In the Kirkland Lake district in Ontario the Wright-Hargreaves is just completing the deepening of the shaft from the 1,000 to the 1,250 level. As soon as this is finished, which will be about Aug. 1, the north shaft will be completed from the 400 level with the winze which has been driven from 700 to 1,250 ft. This will require 250 ft. of sinking. A new hoist is being installed at this shaft, which will be used for handling men and material, leaving the main shaft entirely for the handling of ore.

When the north shaft is completed sinking will again be started at the main shaft. Developments at this property continue to be very favorable. The south vein, which showed very little on the 1,000 level, has been opened up for a continuous length of 450 ft. on the 1,250 level with both faces still in ore. The mill is handling 430 tons a day, and there is no immediate prospect of any increase.

It is believed that both the Lake Shore and the Teck-Hughes will soon start to sink their main shafts again. The Lake Shore shaft is down 1,000 ft. The Teck-Hughes will be continued from the 1,500 to the 1,750 level. Sinking has already started on the Kirkland Lake Gold property from the 2,225 to 2,450 level.

New Steel Concentrator Planned by C. F. Dike Near Joplin

C. F. Dike and associates, of Joplin, have purchased the old Hero mine, located just west of Joplin in the Joplin-Miami district. It is directly south of the A. W. C. tract, which also was purchased by Dike and associates some months ago after an extensive drilling campaign.

The mineralization at both these properties is largely of a sheet-ground character, and cannot be worked at a profit unless prices are unusually high, except on a large production basis. It is understood to be the plan of Mr. Dike to erect a large steel concentrator on the properties eventually, so that large production of ore can be made possible.

Ore at Quartz Mountain, Nev.

Reports from the San Rafael mine, at Quartz Mountain, Nev., are optimistic. An east hanging-wall crosscut on the 250 level from the main incline shaft has cut a vertical mineralized fissure in limestone, and the crosscut has passed through over 15 ft. of vein material containing ore. The south drift on the 250 level continues to show 4 ft. of ore of shipping grade.

No other developments of importance have been reported from the Quartz Mountain and Broken Hills districts, although new work has been started on various near-in properties. Most of this work is of a preliminary nature, and consists essentially of shaft sinking and the installation of compressors and other machinery.

Wrigley Will Build Second Concentrator on Catalina

THE new 100-ton flotation mill erected at Whites Landing, on Catalina Island, by the Wrigley interests, turned out 500 tons of zinc concentrates, which were shipped to Belgium, during the last month and 400 tons of lead concentrates, shipped to the Selby works. The bulk of the ore treated came from the Black Jack mine. This ore is reported to run about 80 oz. silver to the ton. The 20-ft. face of ore in the D. M. Rennie vein, located at the south end of the island, has widened out and shows zinc, lead, and silver.

J. H. Patrick, of Avalon, general manager for the Wrigley interests, has announced that a flotation mill to serve the Renton property will be built at once at Pebbly Beach. During development, the ore from this vein has been shipped to the Whites Landing mill by barge.

North Butte Hopes to Lease Granite Mountain

The North Butte Mining Co., which recently offered $1,500,000 of first mortgage 7 per cent convertible bonds to stockholders, the funds to be used for development purposes, has started cleaning up levels in the Granite Mountain and Speculator claims preparatory to letting out blocks of ground to leasers. R. M. Atwater, president, and Paul A. Gow, general manager, are going over the various properties in Butte and have offered leases along the following lines:

Signed leases will be given to leasers, stipulating that such leasers may work a certain block of ground for a certain length of time, but in no case shall the leaser be entitled to ship more than 10,000 tons of ore unless his lease be extended. Leasers are bound to do a certain amount of work per month, this work to be continuous, except for accidents or unavoidable causes. The company will supply all materials and supplies at cost prices. "Overhead," or services rendered such as hoisting, ventilation, accident compensation and production taxes, is to be charged against each leaser on a per ton shipped basis. From the gross amount of shipments of each leaser there is to be deducted cost of supplies and materials, "services rendered," freight and treatment charges, and "a stipulated amount per ton for leasers' labor." The net after these deducations is to be split 50-50 by the company and leaser. However, the North Butte Mining Co. is not to be responsible for wages either to leasor or men employed by him.

The properties are unwatered only to the 2,800 level, and so far 120 applications for leases have been received to operate above the 2,800. It is planned to unwater to the 3,600 level in a short time and also to arrange to lease the ground that has been developed below the 2,800 level, the arrangement to be, presumably, as detailed.

Tucson Would Have Lead Smelter in Arizona

A serious deterrent to the development of lead-zinc ores in the Southwest has been the lack of a satisfactory market. The only lead smelter in the whole area, which includes Arizona, New Mexico, west Texas, and northern Mexico, is at El Paso. The complaint of mine operators in Arizona and western Mexico is that the freight rates to El Paso are prohibitive on anything but high-grade ores. The same condition prevails on zinc ores, which must be shipped to Amarillo, Tex., or into the Joplin district at rates so high as to make mining of these ores, especially those originating off the main trunk lines, out of the question.

It was intimated some time ago that a lead stack would be installed in the new P-D smelter, at Douglas, and there has also been talk of something in that direction at the C. & A. smelter, but to date nothing tangible has developed. The small production of these lead-zinc ores in that section at the present time is due in part to the lack of reasonable marketing facilities, for it is well known that there are many encouraging prospects. The Tucson Chamber of Mines has been investigating the situation.

Many Companies Active in Red Lake Area

Announcement that the Dome Mines has ordered an extensive line of mining machinery for the development of the Howey property, in the Red Lake area of northern Ontario, has given a great impulse to mining activities in that region. Other companies, including the Coniagas, Huronian Belt, Victoria Syndicate, Anglo-French, Colonial Metals, and Falkenham and Miller syndicates, are actively conducting exploration work, being anxious to prove up the value of their holdings before winter sets in.

The Dunlop Syndicate, operating on a large group of properties 4 miles north and east of the Howey, has made several interesting finds. The latest development in the Red Lake area is the extension of prospecting to the Rickaby Lake area, on the Manitoba border, 6 miles east of Bulldog Lake field of Manitoba. Surface operations confirm the opinion that the Bulldog Lake area extends across the boundary. Bee Lake, which is 65 miles southwest of the Howey discovery, inside the Ontario boundary, is said to contain gold deposits identical with those at Red Lake.

C. & H. Gets Danish Pebbles

Another cargo of flint pebbles direct from Denmark has been received at the Calumet & Hecla Consolidated stamp mills at Lake Linden, Mich., the third for the season. The pebbles are used in the regrinding mills. A very large stock now is on hand. As a grinding medium the pebbles have been found to work most satisfactorily on conglomerate rock. Steel balls and cubes are used on amygdaloid rock in other mills of the Michigan district.

News From Washington

By PAUL WOOTON
Special Correspondent

Hood, White, and Sayers Head Bureau of Mines Branches

Reorganization Plans Go Into Effect—Safety Branch Contrary to Reynders' Recommendations—Lyon Relieved of Burden—Harrington in Important Post

WITH the beginning of the new fiscal year, Scott Turner, director of the U. S. Bureau of Mines, now is in a position to put into effect the changes looking to a simplified and more effective organization of the work under his direction. An order has just been issued formally creating a Technologic Branch, an Economics Branch, and a Health and Safety Branch. Dr. O. P. Hood, who has served the Bureau since 1911 as its chief mechanical engineer, has been selected to head the Technologic Branch. Dr. R. R. Sayers will be chief of the Health and Safety Branch. The Economics Branch, which has been functioning since Jan. 1, is headed by C. P. White, as was announced at that time. Daniel Harrington, of Salt Lake City, is to be chief engineer in charge of the Safety Service Division.

PAUL TO BE "INVESTIGATOR"

J. W. Paul has been relieved of his duties as chief of the Mining Section of the Pittsburgh Station and as chief coal mining engineer. Hereafter he will bear the title of "Senior Investigator," on the study of the special problem of falls of roof and coal. He has chosen John N. Geyer as his assistant. The assignment of Mr. Paul to this particular task is an effort to concentrate on this major cause of accident, which is responsible for 50 per cent of underground fatalities in coal mines. The Bureau heretofore never has been able to concentrate on that problem because of lack of funds. Now that Congress voluntarily voted a special appropriation for that work, Director Turner has chosen the member of his staff who is regarded as being particularly qualified for that undertaking.

IMPORTANCE OF SAFETY

The creation of the Technologic and Economic branches of the Bureau follows the recommendation of the Reynders Advisory Committee. Mr. Turner feels, however, that the importance of the Bureau's safety work is such that it should have co-ordinate rank with the other major subdivisions of the Bureau's work. More than that is involved, however. The direction of rescue operations and of the educational work in safety did not fit in well in either the Technologic or Economics Branch. The research work on explosives, mine lamps, rock dusting, and other matters pertaining to safety will be handled in the Technologic Branch.

The original plan to make the chiefs of branches assistant directors of the Bureau has been held in abeyance. Such plan would require legislation.

During the period that the Bureau's organization has been under study, Dorsey A. Lyon has been serving as Assistant Director, chief metallurgist, and supervisor of stations. In addition he has been in immediate charge of all the technologic work. Under the order just issued, he will be relieved of a portion of the burden he has been carrying. He has chosen to retain his place as chief metallurgist and also will continue to supervise the experiment stations. This will enable him to carry out his desire to spend most of his time in the field. Dr. Lyon, who has been more closely associated with the study of the organization problem than anyone else, expresses the opinion that the present plan is by far the best scheme under which the Bureau has operated.

The Health and Safety Branch will include the Safety Service Division, of which Mr. Harington will be in immediate charge, and the chief surgeon's office. The fact that Dr. Sayers has been made chief of the Health and Safety Branch is not to interfere with his continuing as chief surgeon of the Bureau.

There are two subdivisions of the Safety Service Division. One is the Instruction Section, of which John J. B. Forbes will be chief engineer. The other is to be known as the Emergency Section, of which D. J. Parker will be chief.

CIVIL SERVICE APPOINTEE

Under the new arrangement one of the most important places is that to be filled by Mr. Harrington. The Civil Service Commission conducted a special examination looking to the creation of a list of eligibles for the position of chief engineer of the Safety Service. Thirty-four persons qualified, but the best grade was made by Mr. Harrington. Though Mr. Harrington has been engaged in consulting practice for the past two years, he is an old Bureau of Mines man. He joined the Bureau in 1914 as a mining engineer. In 1920 he became the Bureau's supervising mining engineer. Mr. Harrington was graduated at the Colorado School of Mines in 1900. Prior to his service with the Government he was engineer and chief engineer of the Utah Fuel Co. Later he was general superintendent of the Big Horn Collieries at Crosby, Wyo. He also worked in a consulting capacity with the U. S. Smelting, Refining & Mining Co. He is perhaps known best for his work on ventilation in mines in the Butte district, and is regarded as one of the best qualified men in the West on mine safety and ventilation.

New Impetus to Lead and Zinc Mining in Korea

According to a statement recently issued by the mining section of the Government General of Korea, the total value of the country's mineral production in 1925 was 20,540,000 yen, showing an increase of about 400,000 yen over the previous year. (The yen has a normal exchange value of $0.4985.) The principal production for the year, according to Consul General Ransford S. Miller at Seoul, was gold and silver, valued at 7,430,000 yen, and the principal increases were in gold, gold-silver ore, crude lead, and crude copper. The increase in copper production was due to the partial operation of the Kuhara Kapsan copper mines, which were producing in 1918 but have since suspended operation. The gold production showed an increase in value in spite of the closing down of the Suan mines.

The increased demand in Japan for lead and zinc has given a new impetus to the mining of these minerals. In general, it may be said that the mining industry, which was at its peak in point of values in 1918, has been declining since, is gradually regaining in activity, and now shows a larger quantity production than 1918, although values show a decrease of approximately 10,000,000 yen. During 1925, 278 mining permits were issued, chiefly for coal, gold, and gold-silver, and a number of new prospects are being developed.

Indian Chrome Shipments

Exports of chrome ore, according to Consul E. Verne Richardson, at Karachi, India, through that port during the first four months of the 1926 amounted to 10,870 long tons, compared with 12,706 tons exported during the corresponding period of 1925. All of this product comes from Baluchistan. The 1926 shipment included 2,270 tons to Belgium, 300 to France, 1,250 to Great Britain, 1,650 to Italy, 100 to the Netherlands, 4,800 to Sweden, and 500 to the United States.

Belgians View Radium Mines as Important Asset

That Belgium be allowed to settle a part of its war debts with radium is a suggestion being put forward in that country. Overwhelmed as they are with unpaid obligations, the Belgians are scrutinizing all of their assets closely. They regard radium as one of the greatest of these.

Research work on radium is being encouraged in every possible way. The Belgians believe the possibilities of radium are infinite and that it is destined to become a greater asset than at present.

It has been proved to the satisfaction of many eminent physicians, the Belgians contend, that radium is a cure for cancer. Proper treatment, they point out, requires a mass of radium greater than that possessed by any hospitals in this country.

The proposal is that the Government of the United States purchase radium in quantity so that adequate amounts can be placed in centrally located hospitals in every part of the country. In-

Lake Superior Ore Shipments Should Exceed 54,000,000 Tons

IRON ORE SHIPMENTS from the Lake Superior district are expected to exceed last year's 54,000,000-ton figure. The Oliver Iron Mining Co., a U. S. Steel subsidiary, and larger independents, including Picklands Mather and the Shenango Furnace Co., are increasing operations at their mines on Mesabi range. All open-pit mines in the district are operating at their peaks for the season and are shipping as fast as transportation can be provided, in order that the year's ore quotas may be filled. The mines on the Cuyuna range likewise are active.

dividual hospitals are not in a position to buy $500,000 worth of radium, but the government, in the interest of the public health, could accept radium to apply on the Belgian debt and make the material conveniently available at various points to cancer sufferers.

McIntyre Exploring Claim at Red Lake

The McIntyre, of Porcupine, is proceeding aggressively with the exploration of its claim at Red Lake, and has placed Stanley A. Wookey in charge of operations. One diamond-drill hole located 1,000 ft. from the eastern boundary has intersected the vein, and indicated values are quite consistent. The high-grade chute continues, and veers in a northerly direction up the draw which turns away from the main vein. On the McIntyre's claims lying further to the west no intensive work has yet been undertaken, although some interesting surface showings have been discovered.

Timmins Secures Option on Woman Lake Property

Noah A. Timmins, of Hollinger Consolidated, and associates have taken a short-term working option on the Jackson and Manion properties, at Woman Lake, in the Red Lake mining division of northern Ontario, where a big find was made recently. The properties include a group of twelve claims on Woman Lake narrows, where the portage leads to Rowe Lake, and five claims at Medicine Rock, in lower Woman Lake.

Sues Mining Company for Building Victoria Dam

Gogebic County, Mich., has decided to take action against the Victoria Mining Co. for raising the level of Lake Gogebic by the Victoria dam across the outlet of the west branch of the Ontonagon river. It is charged that the dam has caused the level of the lake to rise at least 12 in. during the last year or two, and that the water will continue to rise unless the mining company removes the dam. It is claimed the lake level has been raised about 30 in. since the dam was built 20 years ago.

Paymaster Plans Concentrate-Cyanide Treatment at Porcupine

At the Paymaster mine, Porcupine, Ontario, the mill is treating 100 tons a day, but additions are being made which are expected to bring the capacity up to 400 tons a day. A tube mill and a new filter are, it is believed, all that is necessary to handle the larger tonnage, and their installation will be completed in about two weeks. The company has announced plans for the construction of a 1,000-ton concentrator and has in view additional units, providing expectations are realized.

The orebody consists of a porphyry mass lying between the serpentine and the Keewatin. This is approximately 100 ft. wide, and is believed to average between $3 and $4 per ton. It has been opened up for a length of 300 ft. on three levels, and is thought to extend for a length of approximately 1,500 ft. There is a crosscut on the 400 level, and the shaft is down 600 ft., but the ore had not been crosscut at that depth.

The present mill is a cyanide plant, which would be used to handle the concentrates from the larger operation.

New Oreshoot at Tonopah

The Tonopah Extension Mining Co., of Tonopah, Nev., reports the opening of a new vein in its Tonopah property. A crosscut from the McCane shaft on the 1,540 level has entered ore, and the ore has been drifted on for 75 ft., showing a width of from four to eight feet of better than milling grade. Work has been resumed on the 1,100 level from the West Tonopah shaft. This 1,100 level work was started several years ago and discontinued on account of water.

Demand for Pig Iron in Birmingham District

Industrial conditions, as regards mining, have reached a new high level in the Birmingham district in Alabama. Increased steel production seems imperatively demanded, and is being provided for, with apparent consideration of and also provision for steadily increasing demand. New steel consolidations have been under active advisement, although nothing definite is as yet known about them. On account of this expectancy, there has been an acute condition as regards the necessary pig-iron supply for pipe-making and similar operations at practically prohibitive prices. Some of the largest pig-iron users are fully alive to this situation and are convinced that they will soon be forced to make pig-iron for themselves, and they are making definite plans to that effect.

The coking coal question is a very knotty problem as regards any new development in pig-iron making, owing to present corporate control of practically all the satisfactory coking coals of the district. It seems fairly well established that mixtures are going to be required, and that brings up a lot of experimentation, as the available high volatile coals can be used only in small amounts by reason of structural defects in resultant cokes.

Joplin Mines Resume After "Fourth" Holiday

AFTER radical reduction in production, following the Fourth of July holiday and continuing over for several weeks, the zinc-lead mines of the Joplin-Miami district are mostly in operation once more. The Barnsdall Zinc Co. properties at Waco, Mo., which were closed April 29, will be reopened again in the near future. Mines of the larger companies, including the Commerce, Skelton, Consolidated, Eagle-Picher, Federal, and Golden Rod, which were closed for the holiday and, to a large extent, for several weeks afterward, are active once more.

Fairbanks Exploration Co. Working Several Hundred Men

The Fairbanks Exploration Co. is making steady progress this summer on its extensive gold dredging project in the Fairbanks District, Alaska. Chief attention is focused on the construction of the 100-mile ditch line which will make the water from the Chatinika River available to the district. This water will be chiefly used to strip the frozen muck which buries the gold-bearing gravels. It is estimated that three or four seasons more will be required to complete the ditch and siphons. Several hundred men are employed this summer on this phase of the project. The company is making good use of mechanical power on this construction; two carloads of gasoline each week are consumed by the power shovels, tractors, and trucks.

The company is still carrying forward an extensive drilling program to complete the work which was initiated several years ago. A supply of water obtained locally is being used in groundsluicing operations on Goldstream and Cleary creeks. Here the tundra is cleaned off from areas in the creek bottoms and the summer sun thaws 2 to 3 in. of muck each day. As this thaws it is swept off with hydraulic nozzles.

Extensive headquarters have been established at Fairbanks. The main office building, which is of concrete-block construction, is now nearing completion, and four modern cottages for officials have been erected near by.

Balbach Company Acquires Control in Stotter Metal

After a year and a half of close co-operation between the Balbach Smelting & Refining Co., of Newark, N. J., and the Stotter Metal Co., of Cleveland, Ohio, the Balbach company has exercised the option which it acquired some months ago to purchase a controlling interest in Stotter Metal Co. The transaction has just been consummated, and simultaneously James W. Paterson, vice-president of the Balbach Smelting & Refining Co., has become president of Stotter Metal Co. Frank H. Andrus, formerly of Waterbury, Conn., has been elected a director and vice-president of the company. Thomas Thomson remains a vice-president.

Electric Expansion in Northern Ontario

J. B. Woodyat, vice-president and managing director of the Power Corporation of Canada, who recently paid a visit to the mining fields of Ontario, states that some idea of the steps being taken to provide the mines with adequate power may be obtained from the fact that the subsidiaries of the Canada Northern Power Corporation will spend approximately $1,000,000 on capital account this year. They have spent about $200,000 on the extension of lines into the Gowganda district to supply power to the Castle-Trethewey, Capitol and Tonopah mines. The load on this line, is increasing monthly, and there are other properties which will be ready to take power in the near future, if it is made available.

In addition, the company through its subsidiary, the Quinze Power Co., is spending $600,000 in building a line into the Rouyn district to supply Noranda and other mines with power. This line, Mr. Woodyat stated, is about one-third completed, and it is expected that it will be ready for operation by November. Northern Canada is also spending $80,000 on a new substation at Schumacher to consolidate the lines entering Porcupine from the various power plants.

Zinc Production in Canada Increases

Revised statistics on the production of zinc for 1925 as reported by the Dominion Bureau of Statistics show that Canada established a new high record for the production of zinc, with a total of 109,268,511 lb. (54,634 tons), which, valued at the average St. Louis price for the year, was worth $8,328,446. Compared with the 1924 output of 98,909,077 lb. (49,455 tons), valued at $6,274,791, the increase amounted to 10.4 per cent in quantity and 32.7 per cent in value.

Receiver for Dominion Iron

The Supreme Court at Halifax on July 2 appointed the National Trust Co. as receiver for the Dominion Iron & Steel Co., a subsidiary of the British Empire Steel Corporation, in accordance with the recommendations recently made by the directors. In a statement issued to the press it is stated that the operations of the Dominion Iron & Steel Co. would be continued and that necessary arrangements will in the near future be made with the banks for the preservation of the rights of the banks and the bondholders.

Tonopah Production Up

Bullion production for the Tonopah (Nev.) district for June totaled $196,000 in value, compared with $161,700 for May. The increase was due principally to larger shipments by leasers on the Tonopah Divide mine, situated 5 miles from Tonopah, to the Tonopah Mining and the West End mills, and partly to increased production resulting from the operations of Tonopah companies.

London Letter

By W. A. Doman

Special Correspondent

City Shies at Newly Issued Dredging Development Shares

No Report by Alluvial Expert — No Returns from Operations Started in July 1925.

London, July 13.—A fortnight ago I referred to the formation of a company called the Dredging Development Co., Ltd., with a capital of £75,000 in £1 shares. Now of these 60,000 shares are being offered to the public. The object is to acquire from the Dome Mining Corporation (Spain) a license to work a portion of the Corporation's alluvial gold mining concessions, and also an option to use the dredge already erected. The properties are situated in the Orbigo River, in the province of Leon, and embrace a stretch of the Orbigo River and Valley about 25 miles in length. G. A. Stockfeld has reported upon the properties.

The new flotation is being freely criticised in the city among mining men. The main points are that the Dome Mining Corporation was formed in 1913, and dredging started in July, 1925, but to date no returns have been made. Has the Dome proved a success? Outsiders have no data upon which to form a judgment. Hitherto I believe Mr. Stockfeld has been mainly connected with reef mining, and has been very successful in West Africa. Technical men, before applying for shares, are asking whether an independent alluvial expert has reported upon the property. It is suggested that this being a dredging company, an engineer with such experience should investigate and make a check report. The bulk of the capital has apparently been obtained in Scotland. There is a rumor that a well-known firm of engineers, with extensive alluvial connections, was asked to report, but stated that is could not see its way to do so. This does not seem to give the new company much of a send-off. The public that fancies mining shares is becoming rather shy after recent experiences, and always wants the report of a first-rate firm of engineers.

The news of the proposed international copper selling organization, cabled from New York, has created considerable interest over here. Representatives of companies reported to be affected are reticent, though there can be no question that some of them have been sounded. Unofficially it is said that the Union Minière du Haut-Katanga has been invited to join. Judging by the brief cabled report of yesterday's annual meeting in Brussels, no reference was made to the matter. Though it would be difficult for the American producers to acquire a controlling interest in the Union Minière—as it was said they endeavored to do last year—it might be possible to induce it to join a pool. The production of the Union Minière is at present less than expected, owing to railway troubles in Africa and some labor shortage.

I understand that the Union Corporation has put in a tender to the South African Government for the 2,641 claims known as the Geduld East. Ground in the Far Eastern part of the Rand has been up for tender on several occasions, but owing to the restrictions and conditions imposed by the Union Government much reluctance has been shown to tender for working the areas. I assume that the Union Corporation would not have submitted a tender now had it not been that the Geduld East claims could be more economically attacked from the Geduld Proprietary Mines than by some other corporation having to sink extensive shafts before testing the ground. So far, it is not known on this side whether competitive tenders have been put in, though it was thought that, say, the Modderfontein East would endeavor to secure the ground. It would be too much to expect that the Union Corporation could secure another "Modder Deep."

German Iron-Ore Production Will Be Subsidized

The German Reich and the states of Prussia and Hesse have decided to subsidize local iron-ore production to permit an increase and to meet Swedish competition, according to a report to the U. S. Department of Commerce from Trade Commissioner Daugherty, at Berlin. The plan is to indemnify the Association (Verein) of Producers in areas affected at the rate of 2 marks per ton. Areas benefiting are the Siegerland (Prussia) and Dill, Lahn & Vogelsberg (Hesse). The term of the subsidy is six months. As a current production of 50,000 to 55,000 tons monthly can be increased to 170,000 tons, it is estimated in Germany that the six months' subsidy will cost around 2,000,000 marks.

This subsidy is expected in Germany to permit more intensive operation by more profitable works and close down those that are not competitive at present. The Siegerland mines have received state help on past occasions. Before the war the ore that they produced was accorded special preferential freight rates.

Will Electrify Sicilian Sulphur Mines; Cost $1,400,000

An agreement has been concluded between the Sicilian sulphur producers and the Societa Generale Elettrica della Sicilia whereby the sulphur mines of the island will be electrified, according to H. C. MacLean, U. S. Commercial Attaché, Rome, Italy.

A large steam-power plant will be erected at Catania and three-phase energy transmitted at 40,000 volts to transformer stations at Castrogiovanni, Saltanissetta, Sommatine, and Campofrance, from which secondary lines at 10,000 volts will run to the principal mining centers. When complete the system will have about 310 miles of line.

The estimated cost amounts to 35,000,000 lire (one lire=$0.04 at the present rate of exchange). The project will be finished in about three years, according to reports in Italy.

Societies, Addresses, and Reports

Joint Mining Meeting at Denver in September

A.I.M.E., Petroleum Geologists, Silver Producers, and Mining Congress Will Participate in Convention—Many Subjects on Program

THE American Institute of Mining and Metallurgical Engineers, the American Association of Petroleum Geologists and the directors of the American Silver Producers' Association have arranged to hold a joint meeting with the Western Division of the American Mining Congress at Denver, Colo., during the week of Sept. 20, and to this end these organizations urge their members, as well as others directly interested, to meet with them for a thorough consideration of the major problems that may be appropriate for each organization, or for combined action by all.

Questions for consideration will be presented by speakers of national reputation and experience. It has been arranged that discussion of an economic or semi-political nature shall be under the auspices of the Western Division of the American Mining Congress, and that the American Institute of Mining and Metallurgical Engineers and the American Association of Petroleum Geologists will consider new technical progress in mining, metallurgy, and the petroleum industry.

To Debate Status of Public Lands

Among the topics to be considered by the American Mining Congress will be the policy of the National Government regarding the holding or disposition of public lands, particularly as affecting the mining industry. Hubert Work, Secretary of the Interior, has been invited to address the convention.

Another question for consideration and discussion by the Mining Congress will be the Leasing Act as affecting the public land states. Has its operation proven generally beneficial to the western states? Have the benefits to the states in which federal lands are located compensated for the loss suffered on account of the withdrawal of coal, oil, and shale lands from private ownership, which would otherwise be a taxable asset for these states?

Should the present tendency of Congress to extend the provisions of the Leasing Act and to foster further withdrawals of public lands be encouraged or resisted, and have the states a sound basis for resistance?

Is it a fair and equitable distribution of the funds derived from royalties under the Leasing Act that 37½ per cent should be returned to the states from which they were derived; 10 per cent to be retained at Washington for administration expenses, and 52½ per cent devoted to reclamation projects for agricultural purposes?

H. Foster Bain, secretary of the American Institute of Mining and Metallurgical Engineers, will tell the story of this organization's activities, and how its work can be made more helpful. M. J. Gavin, refinery engineer, U. S. Bureau of Mines, will report on initial operation of government oil-shale plants recently installed at Rifle, Colo. M. F. Coolbaugh, president of the Colorado School of Mines, will speak on "Progress of Leaching and Electrolytic Metallurgy." A. J. Weinig, superintendent of the ore-testing plant, Colorado School of Mines, will address the convention on the subject of "Selective Flotation."

Secretary Herbert Hoover is expected to address the convention upon current issues affecting the mining industry as presented to the United States Department of Commerce. George Otis Smith, Director of the U. S. Geological Survey, will tell how this department is preparing to meet new conditions. Dr. W. C. Mendenhall, chief geologist, U. S. Geological Survey, will describe the Colorado plan of co-operative geological survey, and G. F. Loughlin, chief of metalliferous geology, U. S. Geological Survey, will speak on "Deep Mine Development at Cripple Creek."

A meeting of the board of directors of the American Silver Producers' Association has been called to convene in Denver during the week of the convention. For the last two years or more this organization has been gathering first-hand information in the United States and foreign countries respecting the silver situation. The association has probably now assembled for consideration more direct and vital facts bearing on this question than were ever before compiled by any other agency, either governmental or private.

At this meeting will also be determined whether Western silver producers are to continue their indifferent and half-hearted support of the pending Pittman Act, providing for the completion of silver purchases as contemplated by the former act, or whether, by giving the measure now pending enthusiastic support, they will insure its passage when Congress reconvenes.

James F. Callbreath, secretary of the American Mining Congress, will tell how this effective organization has brought about unified effort in behalf of the industry by all of the allied industries engaged in the development of the mineral resources of the country.

The American Association of Petroleum Geologists will hold three half-day sessions during the convention. It is expected that a general program of geological subjects will be presented covering subjects of interest to the oil geologists on Western Midcontinent, Rocky Mountain, and California districts.

Several other speakers of national fame in addition to the above mentioned have been invited to speak on special subjects, and an opportunity for informal discussion of other problems will be afforded, among which will be: federal blue-sky legislation, revision of federal mining laws, proposed tariff on copper, federal legislation respecting stream pollution, surface rights to mineral land as affected by proposed Grazing Act, and dangerous trend of compensation insurance legislation.

A.I.M.E. Nominating Committee Invites Suggestions

THE Nominating Committee of the American Institute of Mining and Metallurgical Engineers calls attention to the fact that it is anxious to receive suggestions for the officers of the Institute for 1926.

The offices to be filled are as follows: President, two directors, to be also vice-presidents, and five directors.

The retiring directors are as follows: E. DeGolyer, director and vice-president, District 0; Charles W. Merrill, director and vice-president, District 10; R. V. Norris, District 2; George Otis Smith, District 4; P. B. Butler, District 6; Bertram D. Quarrie, District 3; L. D. Ricketts, District 9. The gentlemen are eligible for re-election.

Suggestions should be made to Graham Bright, Chairman, Nominating Committee, American Institute of Mining and Metallurgical Engineers, 1302 Union Trust Building, Pittsburgh, Pa.

Butte Section A.I.M.E. Hears About "Deepest" Mine

A special meeting of the Montana Section of the A.I.M.E. was held at the Silver Bow Club, Butte, on July 21, the guest of honor being Eric Davies, chief engineer for the St. John Del Rey mines, in Brazil. Mr. Davies is in this country to gather ideas looking toward reducing operating costs at his property, through the use of labor-saving machinery. He read a paper, illustrated with slides, covering operating problems at the Del Rey, showing how ore, men, and supplies are handled and how ventilation is effected at the deepest mine in the world.

The property employs 1,000 men underground and about 2,500 on the surface, the average pay being from $1.20 to $1.50 per day for miners, this being dependent upon price of exchange. Women who sort ore on the picking table are paid about 40c. per day. The orebody, which is rather flat, is opened by a series of vertical offset shafts. This body, which has been followed to a vertical depth of 7,000 ft. is 1,000 ft. wide and about 8 ft. thick.

Exhibitors at Leipzig Number 13,000

At the Leipzig Trade Fair, which opens in August, more than 13,000 exhibitors will take part, and some 200,000 buyers from all parts of the world will attend. American manufacturers are cordially invited to exhibit their products. The fair offers a unique opportunity to display goods in rivalry with those of Europe.

The growing interest of America in the fair is shown by the fact that more than 1,500 buyers from the United States will attend. Mining machinery and equipment will be featured.

Recent Technical Publications

Reviews, Abstracts, and References

Iron in Antiquity. By J. Newton Friend. Charles Griffin & Co., Ltd., London. J. B. Lippincott Co., Philadelphia, Pa.

Those who have retained the youthful habit of asking questions about the origin of things they see and have to do with daily, will find in this little book many interesting paragraphs as well as a convenient digest, properly referenced, of the gleanings of antiquarian research into the intriguing subject of the history of iron. As with the dictionary, one may dip into it at almost any point and find a story, short but complete even within the limits of a page. After a few preliminary chapters on ancient uses of iron in general Mr. Friend focuses his attention on the countries of antiquity in succession, giving each its own chapter. These chapters have little connection with one another, even as the countries themselves. The author concludes by expressing the hope that the time spent in unraveling the ancient history of iron, and thereby throwing light upon the customs and manner of life of our early ancestors, will not be regarded as lost or wasted. No effort that entertains is ever wasted. Besides, the antiquarian's work is something like the labor of the researcher in pure science. One never knows when some discovery will prove of practical value.

The Metallography of Steel and Cast Iron. W. E. Woodward. Crosby Lockwood & Son, London. 15 s. net.

From some of his lectures delivered in the engineering laboratory at Cambridge University the author has prepared this volume. His object has been, he says, to present in compact form the metallography of steels and cast irons, with particular reference to those alloy steels that are of industrial importance. The topics of the various chapters are: "The Alloys of Iron and Carbon"; "The Thermal Critical Points in Iron and Steels"; "Special Steels"; "Theories of Hardening"; "Cast Iron"; and "Pyrometry."

Canadian Resources—The Canadian Pacific Railway has issued more than fifty pamphlets describing the situation existing in the various mineral industries in Canada. Most of the pamphlets are three or four pages in length and set forth briefly the salient facts. One of them is devoted to the water-power situation in Canada and four to the forest situation in various parts of the Dominion. These synopses can be had on application to the Development Branch, Department of Colonization and Development, Canadian Pacific Railway Co., Montreal, Canada.

South Dakota—The report of Otto Ellerman, State Mine Inspector for South Dakota, has recently been issued. It covers the year ended Dec. 31, 1925. Details of mining, except coal mining, are given by counties. Part of the bulletin is devoted to a list of serious accidents that occurred during the year; a directory of mines, except coal mines, is included.

Persia — The first bulletin of the Persia Society has been received from the secretary of that new organization, at 247 Park Avenue, New York City. The purpose of this society is to promote sympathy and good will between the United States and Persia, to disseminate knowledge about the latter country, and to assist American business men in developing the opportunities that are said to await them there.

Geophysics — "Methoden der Angewandten Geophysik," by Dr. Richard Ambronn, of Gottingen, Germany, has been received from the publisher, Theodor Steinkopff, Dresden and Leipzig. A review will be published in a future issue.

Japan—The Association of Mine Owners, of Japan, has issued a bulletin of 92 pages entitled "Explanatory Notes on Mining in Japan." In it the Japanese exhibits at the Sesquicentennial International Exposition at Philadelphia are described; 34 pages of notes on mining are included. A section is devoted to a discussion of mining in ancient times and another section to an outline of mining legislation.

Flotation—In a six-page article in the *Mining Congress Journal* for July 1926, A. C. Munro and H. A. Pearse discuss flotation progress at Britannia Beach, B. C. A flow sheet and several tables of operating data are included.

Flotation—A. E. Paton, metallurgist for the South Kalgurli Consolidated, Fimiston, Western Australia, is the author of a four-page article entitled "Dry Crushing and Flotation" in the June 5 issue of the *Chemical Engineering and Mining Review*, of Melbourne.

Copper Mining—The July issue of the *Excavating Engineer* contains an article by E. M. J. Alenius entitled "Present Open Pit Practice at the United Verde Mine."

Patents

Petroleum — No. 1,591,011, July 6, 1926. Troy Almond Leonard Bowen, Tulsa, Okla. An oil well derrick.

Furnace—No. 1,591,090, July 6, 1926. George H. Isley, Worcester, Mass., assignor to the Morgan Construction Co., Worcester. Apparatus for reversing and control of regenerative furnaces.

Sampling—No. 1,591,092, July 6, 1926. Alexander Grant McGregor, Warren, Ariz. A sampling apparatus.

Filter—No. 1,591,229, July 6, 1926. Edwin Letts Oliver, and John F. Borden, Oakland, Calif. A filter of the tank type having filtering units in the tank.

Phosphate — No. 1,591,271, July 6, 1926. Henry Blumenberg, Jr., Los Angeles, Calif., assignor to Stockholders' Syndicate, Los Angeles. A process of treating phosphate rock so as to form potassium phosphate.

Rock Drill—No. 1,591,376, July 6, 1926. Charles C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City. A means for guiding a rock-drill steel in drilling operations.

Gold—No. 1,591,420, July 6, 1926. Antonio M. Garcia, Stockton, Calif. A device consisting of a sluiceway and screen for saving fine gold.

Hoist Brake—No. 1,591,621, July 6, 1926. Harry V. Haight, Sherbrooke, Que., assignor to Ingersoll-Rand Co., Jersey City. A gravity air brake for a hoisting engine.

Rod Mill—No. 1,591,703, July 6, 1926. Roy C. Greenfield, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee.

Hoist—No. 1,591,884, July 6, 1926. Arthur E. Peters, Littleton, Colo., assignor to Ingersoll-Rand Co., Jersey City, N. J.

Ball Mill—No. 1,591,916, July 6, 1926. Povl T. Lindhard, Brooklyn, N. Y., assignor to F. L. Smidth & Co., New York. A ball mill having a preliminary grinding compartment and a separating compartment.

Track Shifter — No. 1,592,153, July 13, 1926. Ernest E. Peterson, Hibbing, Minn. A track-shifting machine.

Nickel—Nos. 1,592,306 and 1,592,307, July 13, 1926. Winfield Schley Lienhardt, Stapleton, N. Y., assignor to Metal & Thermit Corporation, Carteret, N. J. Both cover a process of recovering nickel from solutions.

Gyratory—Nos. 1,592,312, 1,592,313 and 1,592,314, July 13, 1926. Edgar B. Symons, Bakersfield, Calif., assignor to Symons Bros. Co., Bakersfield. These cover a crushing head of a gyratory crusher, a gyratory cone crusher, and an oiling means for a gyratory crusher, respectively.

Potassium—No. 1,592,757, July 13, 1926. Joseph F. Cullen and Thomas E. Harper, Midvale, Utah, assignor to U. S. Smelting Refining & Mining Co. A process for extracting potassium and phosphorus from rocks by volatilization by smelting under reducing conditions and recovering the potassium and phosphorus compounds from the gases so produced.

Crusher—No. 1,151,942, July 6, 1926. Ray C. Newhouse, Wauwatosa, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. A crusher of gyratory type.

Cobalt, Nickel—No. 1,590,525. June 29, 1926. Frank O. Kichline, Lebanon, Pa., assignor to Bethlehem Steel Co. A process of extracting nickel and cobalt from ferruginous ores.

Gold—No. 1,590,584. June 29, 1926. John E. Logan, Washington, D. C. A centrifugal gold extracting machine.

Power Shovel—No. 1,590,622. June 29, 1926. John R. Zygalinski, New Haven, Conn. A power shovel having a rotatable platform on which a cylinder is mounted horizontally.

Petroleum—No. 1,590,773. June 29, 1926. William H. S. Moore, Cleveland, Ohio. An oil well under-reamer.

Mine Car—No. 1,590,861. June 29, 1926. William L. Scribner, Canton, Ohio, assignor to the Timken Roller Bearing Co., Canton. A differentiating mine-car axle.

People You Should Know About

J. V. N. Dorr, president of The Dorr Company, sailed recently for Europe. He will remain abroad for about six weeks.

William Spence Black has gone to Nova Scotia to examine mining property. He will return to Boston early in August.

Karl C. Stedtmiller, consulting mining engineer of Los Angeles, was married in New York recently to Miss Asabel De Hyse.

Wilbur H. Grant, mining geologist, of San Francisco, is en route to Mexico City, Mexico, in the interest of the Mexico Power & Light Co.

Professor Y. Yokobari, head of the department of mining, University of Tokio, Tokio, Japan, is in California on his way around the world.

H. R. Hill, consulting engineer to the Union Corporation of South Africa, accompanied by Mrs. Hill, has left Capetown, en route to England.

Dwight E. Woodbridge has returned to Duluth from western Ontario and has gone to the Yale district of British Columbia for a few weeks' stay.

Colonel W. B. Thompson, who recently returned to this country from a trip to France, expects to visit his estate near Superior, Ariz., early in August.

Pope Yeatman was made a doctor of engineering by Washington University, in St. Louis, at its last commencement, and not an LL.D., as previously announced.

Arthur W. Jenks, who is in southern Oregon, will remain in that district for several months. He is developing gold prospects for Indiana and Washington clients.

Ira B. Joralemon and **E. H. Dawson,** mining engineers of San Francisco, were recently at Hamilton and Treasure Hill, Nev., where they have mining interests.

Heath Steele, president of the Cia. Minera de Peñoles, a subsidiary American Metal Co., has gone Guatemala. He will return in September.

Walter G. Swart, of Duluth, has just returned from Cusihuiriachic, Mexico, and is now in British Columbia, on professional business in the vicinity of the Sullivan mine.

William J. Quigley, president of the Howe Sound Co., has left New York for an inspection trip to the company's properties at El Potosi, Mexico, and at Britannia Beach, B. C.

Irwin H. Cornell, vice-president and sales manager of the St. Joseph Lead Co., sailed last week, accompanied by his family, for a vacation in England, France and Switzerland. He expects to return about Sept. 12.

Essington Lewis has been appointed managing director of the Broken Hill Proprietary Co., New South Wales, Australia, filling the vacancy on the board caused by the death of William Jamieson. Mr. Lewis has had twenty-two years' experience on the staff of the company, and has been general manager since the beginning of 1921.

Andrew T. Sweet, assistant professor of metallurgy and ore dressing at the Michigan College of Mines, Houghton, has been promoted to be head of this department. Since last fall he has been the acting head. Professor Sweet is a native of Wakefield, Mich., where he was born on Oct. 16, 1890. He was graduated from the high school at Marquette, Mich., in 1909, from the Marquette Northern Normal School in 1913, and from the Michigan College of Mines in 1916, with degrees of engineer of mines, bachelor of science, and metallurgical engineer. He engaged in mill construction and blast-furnace operation until the entry of the United States into the World War in 1917,

Andrew T. Sweet

when he became interested in the organization of an engineer battalion for the thirty-second division. He was actively identified with recruiting and organizing three companies. He was appointed master engineer and later second lieutenant. He went to France in December, 1917, and during the Aisne-Marne offensive was promoted to first lieutenant. His subsequent appointment as liaison officer with the Tenth French army was quickly followed by promotion to demolition engineer. Effective work for his company, B 107th Engineers, in the Oise-Aisne offensive led to a citation and decoration from the French. He was promoted to a captaincy in the Argonne offensive, following which he was decorated both by the French and United States governments. On June 1, 1919, following his honorable discharge from the service, he was appointed instructor in the metallurgy department of the Michigan College of Mines. During certain periods in 1920 and 1921 he was engaged in ore research work for the McIntyre Mining Co. in Ontario, Canada. During the last two years he has been employed by various firms or individuals as a private consultor in ore tests, cyanidation, amalgamation, leaching and flotation. Professor Sweet is now in the midst of highly important experimental work on concentration of copper carbonate by flotation, extraction of silver from copper mineral, and extraction of copper from slag, the program involving thousands of experiments. His travels in research work have carried him into several foreign countries as well as into the principal mining fields of the United States. He is a member of several technical societies and the author of a number of metallurgical works and treatises.

Adolph Knopf, of the geology department, Yale University, is in San Francisco, en route to Pioche, Nev., where he will stay two months investigating the economic geology of the Pioche district for the U. S. Geological Survey.

Dr. Edwards, one of the directors of the Boulder Perseverance, Ltd., Western Australia, lately arrived in that state on a visit from London. He is engaged in a special mission connected with the once famous Boulder Perseverance mine.

Edmund Davis, a director of the British South Africa Co., also chairman and director of a number of Rhodesian companies, has just completed an extensive tour in Rhodesia. After a week in Johannesburg, with Mrs. Davis, they left for Capetown, en route for London.

J. Mackintosh Bell, managing director in Canada of the Huronian Belt Co., Ltd., has returned from an inspection of all the properties in which the company is interested excepting those in the Red Lake area and northwestern Quebec, and expresses himself as being well satisfied with existing conditions.

S. Spencer Nye and **Martin J. Buerger,** of the Geologic Branch of the U. S. Bureau of Mines, have been appointed junior geologists. Mr. Nye will assist **E. T. McKnight** in fuel section work near Thompsons, Utah, and Mr. Buerger has been assigned to work with **Mr. Gilluly** in the Oquirrh Range, Utah, under the metalliferous section.

N. A. C. Smith, of Worcester, Mass., has been appointed superintendent of the Petroleum Experiment Station of the U. S. Bureau of Mines, at Bartlesville, Oklahoma. He succeeds **E. P. Campbell,** who recently resigned. Mr. Smith has been connected with the Bureau of Mines since 1918 and has been stationed at Washington, Pittsburgh, and Bartlesville.

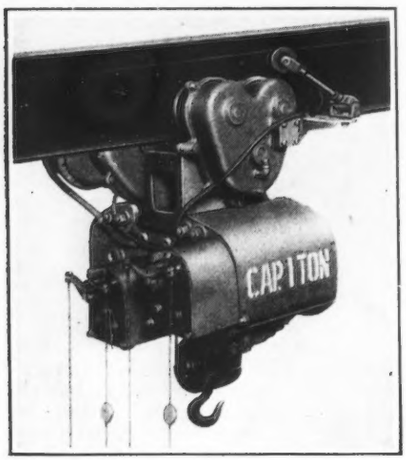
Colonel Cobbold, A. Burt, and Mr. Hutchison, a South African engineer, are now in Canada examining mining properties on behalf of the Latilla interests, of London, England. Mr. Hutchison is in the South Lorrain district looking over the Bellellen mine with a view to making an early report to London principals. He will also inspect properties in Kirkland Lake and British Columbia before returning to England.

W. M. Weigel, who for the last five and one-half years has been mineral technologist of the U. S. Bureau of Mines at its Southern Experiment Station, at Tuscaloosa, Ala., and Washington, D. C., has accepted a position with the Missouri Pacific R.R. Co. His headquarters will be at the offices of the railway company, Railway Exchange Building, St. Louis, Mo. Mr. Weigel will make a study of the mineral resources of all kinds in the Missouri Pacific territory, with the object of assisting both producers and consumers.

New Machinery and Inventions

A Trolley for Small Hoists

A new motor-driven trolley has been developed by the American Engineering Co., Philadelphia, for use with its ½-ton and 1-ton Class A "Lo-Hed" electric hoists, which have been built heretofore in bolt-suspension and plain trolley types only. The trolley can be supplied with travel speed of 80 or 120 ft. per minute. It can be arranged for remote control, if desired. Any of these hoists now in service can be easily converted into a motor-trolley hoist by adding a new trolley. Only 22-in. headroom is required for the hoist and the trolley, and maximum traction is obtained by driving all four wheels. The three main



This motor-driven trolley can be arranged for remote control

castings, from which the hoist and load are suspended, are of cast steel. The spur gear drive is totally inclosed and runs in an oil bath. Hyatt roller bearings are used on all shafts. The motor can be furnished for d.c. or a.c., either 2- or 3-phase.

Portable Compressors Improved

A portable air compressor of 320 cu.ft. per minute capacity has been added to the Sullivan line of portable compressors. These are now available in four different sizes—namely, 110, 170, 220 and 320 cu.ft. per minute capacity, all direct-connected to a Buda 4-cylinder, 4-cycle, tractor-type gasoline engine. This combination, it is stated, has proved unusually smooth running and reliable, as all moving parts of both compressor and engine are carefully balanced to eliminate vibration, and the two units are coupled together to preserve this balance in operation.

The 320-ft. compressor unit is of the V or opposed type, the two pairs of cylinders being set at an angle of 90 deg. with each other, the connecting rods running to a common crank shaft.

Another feature which has been adopted for all these compressors is the "Protectomotor" air filter, which is now supplied both on the compressor intake and on the engine intake, thus increasing the life of both compressor and engine by eliminating troubles from the entrance of dirt and grit into the machinery. Both engine and compressor are fully inclosed, are splash lubricated, and are water-cooled, a radiator of ample proportion being provided. The compressors are available on steel wheel mountings or on trailer trucks with spring suspension and rubber tires for use on city streets. The 110 ft. unit may also be mounted on a Ford 1-ton truck, and units of any size are available on skid mountings.

New Sluice Box Riffle

The adaptation of spongy rubber to sluice boxes, undercurrents, and dredger gold-saving appliances is being made by the Frank S. Morgan Co., of 2927 Newberry St., Berkeley, Calif. A special kind of sponge rubber suitable for the purpose is now being made and is being introduced under the trade name of "Mat-O-Gold." A patented steel sluice box, made in widths of 8, 18, and 32 in. by 15 ft. in length, has been placed on the market. The sluice is provided with traps, which discharge under a smooth rubber mat, one end being fastened and the other free.

In place of the ordinary riffles, sheets of sponge rubber are used. It is claimed that the resiliency of the material is an important factor contributing to the life of the riffle surface. The surface is cellular or full of small irregular pores, which serve as pockets in which fine and coarse gold lodges. In addition to this use, a vanner belt is being constructed with a sponge rubber top. It is expected that the efficiency of the vanner will be increased.

A New Melting Pot

An addition has been made to the Trent line of rapid-heating melting pots. The new pot has a capacity of 10 lb. and is suitable for melting babbitt, solder, lead and tin. It is adapted for 110 and 220 volts a.c., and can be connected to a lamp socket. It will be noticed that there is a new design of protected plug contacts, whereby a standard plug can be used to obtain the three-heat combination. All pots are fitted with spouts and two handles to facilitate pouring metal if so desired. The crucible is insulated, affording high efficiency, it is claimed.

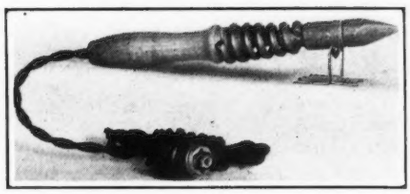
Roberts & Schaefer Purchase Car-Dumper Company

The Roberts & Schaefer Co., of Chicago, has purchased the assets and business of the Car-Dumper & Equipment Co., of Chicago, and has taken over the manufacture and sale of the rotary car dumpers, car feeders, car controls, and all other equipment previously manufactured and sold by that company. Roberts & Schaefer will also complete all unfinished contracts and will be prepared to supply repair parts for all car-dumper equipment.

The acquired lines will be handled for Roberts & Schaefer in a department to be headed by George N. Simpson, president of the Car-Dumper & Equipment Co.

Electric Soldering Iron

A light-weight soldering iron designed to heat up quickly and made in standard sizes ranging from ½ in. to 1¼ in. tip is a new product of the General Electric Co., Schenectady, N. Y. Power consumption ranges from 70 watts for the smaller iron to 350 watts for the larger size. The irons for heavy duty are provided with radiating stands for the purpose of maintaining the iron at the correct operating temperature when temporarily not in use. Heat from the copper tip is prevented from reaching the handle by means of a spiral made from steel rods. Instead



A light soldering iron

of the mica usually used as an insulator, the heating unit uses an insulating powder so highly compressed that it becomes a good heat conductor and will withstand temperatures of more than 2,000 deg. F.

Trade Catalogs

Reduction Gears. — Pressure oiling systems for worm reduction gears are described in a leaflet issued by the De Laval Steam Turbine Co., of Trenton, N. J.

Blasting.—A blaster's scale has been issued by the Hercules Powder Co., Wilmington, Del. It is thought that this will be convenient and helpful to anyone in charge of blasting operations where well-drilled holes are used. Free copies may be obtained from the company. Two tables are given on the scale. From one may be calculated the number of cubic yards of material in the solid displaced per foot of hole at different spacings.

Oil and Gas Burners.—Bulletin 270 of the W. S. Rockwell Co., 50 Church St., New York, N. Y., covers Rockwell oil and gas burners for industrial heating furnaces. The material in this has been prepared with a view to developing a better understanding of the function of oil burners in industrial heating operations.

Pyrometer. — Bulletin 293 of the Bacharach Industrial Instrument Co., 7,000 Bennett St., Pittsburgh, Pa., describes the H-K optical pyrometer (Holborn-Kurlbaum).

Power Hammers.—The Central hammer manufactured by the Central Machine Works Co., 1234 Central Ave., Minneapolis, Minn., is described in a bulletin recently issued by the company. This hammer is a redesigned model of the force trip hammer long manufactured by the company.

Diesel Engines.—Bulletin 1010 of Fairbanks, Morse & Co., Chicago, Ill., is entitled "Economy Deisel Engine Power." This bulletin makes an analysis of the various factors which effect the cost of power. The costs of a typical small Diesel power plant are analyzed.

The Market Report

Lead Prices Advance; Other Metals Firm

New York, July 28, 1926—Two advances in the price of lead accompanied by a good volume of business, were the features of the non-ferrous metal markets in the week ending today. Copper prices, also, are about 15 points above those of last week, with continued good sales, and tin is slightly higher. Silver and zinc are practically unchanged from the levels of last Wednesday. All London prices are somewhat higher than a week ago.

Copper Nominally 14⅜c.

Until Tuesday, practically all copper sellers booked business at the same level that obtained last week—14¼c. delivered in the East, with a few good orders at Middle Western points at 14⅜c. The volume of sales continued excellent, and with the slightly firmer quotations ruling in London, some sellers, on Tuesday, advanced their prices, quoting from 14.30 to 14⅜c. in the East, and 14¼c. in the Middle West. Business at the higher levels has not been so good as before. Today, one consumer was offered copper at 14.325c., apparently the low quotation, but the general asking price in the East was 14⅜c., and in the Middle West, 14¼c. More September-October business has been booked, probably to cover the requirements of manufacturers for finished material already ordered; there is little or no buying except to cover assured needs. Some November copper can also be secured at current prices, though the demand does not yet extend to that month. Some producers are out of copper for early shipment, but others seem to have sufficient to meet reasonable demands, and there is no reason for any panicky feeling regarding supplies. The brass business continues exceptionally good, but some consuming lines are experiencing a little midsummer dullness. The foreign market has not been particularly active, but is decidedly firm, with American agencies quoting 14.55c., c.i.f. today, and dealers about 10 points lower.

Daily Prices of Metals

July	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
22	14.05	62.125	63.50	8.50	8.45	7.45@7.50
23	14.05	62.50	63.75	8.675	8.575	7.45@7.50
24	14.05	62.50	63.75	8.65	8.575	7.45@7.475
26	14.05	62.75	64.00	8.775	8.60@8.675	7.45@7.50
27	14.125	62.75	63.75	8.775	8.675	7.475@7.50
28	14.15	62.75	63.625	8.75	8.675	7.475@7.50
Av.	14.079	62.563	63.729	8.687	8.598	7.477

The prices correspond to the following quotations for copper delivered: July 22d, 23d, 24th, 26th, 14.30c.; 27th, 14.375c.; and 28th, 14.40c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
22	58¼	59	66	286¾	283	32⅛	31 13/16	34	34 7/16
23	58¼	59	66	287½	283	32 3/16	32	34⅛	34½
26	58⅜	59⅛	66¼	289	284	32 3/16	32½	34⅛	34⅝
27	58⅜	59¼	66¼	289⅜	284¼	33⅜	33	34⅜	34 13/16
28	58½	59¼	66½	289⅞	284¾	32⅞	32½	34 7/16	34 13/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver		Gold London	July	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
22	4.85 7/8	64½	29 11/16	84s10½d	26	4.85⅝	63⅞	29½	84s10½d
23	4.85¾	64½	29 11/16	84s10½d	27	4.85⅝	63⅞	29½	84s10½d
24	4.85¾	63⅞	29½	....	28	4.85⅝	64¼	29⅝	84s11½d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Lead Active in Middle West

Spirited buying in the Middle West has brought the St. Louis market for lead to within about 7½ points of the Smelting company's price in New York. The leading interest in the Middle West has been content to follow rather than lead the market upward, and has made sales to favored customers at levels somewhat below the prevailing figure, which yesterday and today has been 8.675c. On the other hand, a little higher price has been realized on some lots sold by second-hands. There is not a great deal of Soft Missouri available for shipment prior to the second half of August, but there seems to be no difficulty in getting desilverized in the Middle West for early delivery. On July 23 an increase in the London price was followed by a mark-up of $3 a ton by the American Smelting & Refining Co., making its price 8.65c., New York. London retaliated with another jump on Monday, the 26th, whereupon the Smelting company increased its price to 8.75c. A still further increase in London on Tuesday occurred, but the Smelting company appears to have considered the price high enough, and today London dropped back virtually to the level of Monday. Students of the situation are inclined to believe that the London strength is due to speculative influences rather than to any great underlying improvement. Aside from the limited volume of business in the Eastern market the feature of the domestic situation is the brisk demand on the part of corroders.

Zinc Unchanged at 7.475c.

Zinc sold in substantially greater volume than last week, with one seller doing the lion's share of the business. Prices have ranged from 7.45 to 7.50c. for all deliveries, though sellers would be a little more anxious to sell forward than spot. Galvanizers, however, are showing little interest in anything later than August, and are in most cases buying only from hand to mouth. High-grade continues at 9c. per pound delivered in the East.

Tin Market Strong

Although consumers have not been particularly active in the domestic tin market, prices during the last week have been strong. London price has been a little higher each day, and this has prompted speculative buying at firm prices on this side. October delivery is from ⅜ to ½c. under prompt. The supply of 99 per cent is none too plentiful and the spread between it and Straits is only about one cent per pound.

French Francs Recover

The strong vote of confidence which the Poincaré cabinet received has stiffened French exchange materially. Lire likewise are higher than a week ago. Closing cable quotations on Tuesday, July 27, were as follows: francs 2.51c.; lire 3.21c., and marks 23.81c. Canadian dollars are at a premium of 11/64 per cent.

Silver Closes at 64¼c.

Silver recovered slightly on the 22d, but the higher level held for only one day, and was followed by a sharp drop to 29½d. in London, and 63¾c. in New York, due to declines in both the Chinese and Indian rates. Relatively small business was done locally at the lower quotations, but on the 28th buying for China account caused some improvement. The market closes quiet and steady.

Mexican Dollars (Old Mexican Pesos): July 22d and 23d, 49¼c.; 24th, 26th, and 27th, 48¾c.; 28th, 49c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—99 per cent grade, 27@28c. per lb.; 98@99 per cent, 27c.; 94@99 per cent, 26c. London, 98 per cent, £116@£118 per long ton.

Antimony—Per pound, duty paid, New York: Chinese brands, spot, 14¾@16c. August arrival, 14½@15¾c. Cookson's "C" grade, spot, 18½@18¾c. Market firmer with buying by consumers and dealers. Reports from China disquieting.

Bismuth—Per pound, New York, in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per pound, New York, 60c. London, 1s. 10½d. for American metal; 1s. 9d. for Australian metal.

Iridium—Per ounce, $125@$135 for 98@99 per cent. Nominal. London, £63@£65 in iridio-platinum.

Nickel—Per pound, ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton according to quantity.

Osmium—Per ounce, $65@$75; London, £17@£20.

Palladium—Per ounce, $69@$71. Pure metal as a constituent of crude platinum, $60@$65 per oz. London, £12@£15, nominal.

Platinum — Refined, per ounce, officially quoted, $115. Sales also at $112@$113. Pure metal as a constituent of crude platinum, $109. Market has stiffened in the last few weeks; better buying.

London, £23½ per ounce for refined, and £21@£22 for crude. Demand limited.

Quicksilver—Per 75-lb. flask, $88@$89, the higher quotation ruling for futures. Good sales at the lower prices. San Francisco wires $90; steady. London £15.

Ruthenium—Per ounce, $60@$70, nominal; London, £12@£15.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Radium, Rhodium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium** are unchanged from the issue of July 3.

Metallic Ores

Tungsten Ore—Per unit of WO_3, N.Y.: Wolframite, $10.50@$10.60; Western scheelite, $10.75. Market shows some life as a consequence of unrest in China.

Vanadium Ore—Containing 4 to 8 per cent V_2O_5, 30@35c. per pound of V_2O_5 f.o.b. Montrose, Colo.

Foreign concentrate (lead vanadate) 12 to 18 per cent V_2O_5, 60@65c. per pound V_2O_5, duty paid, seaboard.

Chrome Ore, Iron Ore, Manganese Ore, Molybdenum, Tantalum, and Uranium are unchanged from quotations in the July 3 issue.

Lead Ore Again Advanced; No Change in Zinc Blende

Joplin, Mo., July 24, 1926

Zinc Blende	Per Ton
High	$53.00
Premium blende, basis 60 per cent zinc	$51.00@52.00
Prime Western, basis 60 per cent zinc	50.00
Fines and slimes, 60 per cent zinc	49.00@45.00
Average settling price, all zinc	47.96
Galena	
High	$108.45
Basis 80 per cent lead	107.50
Average settling price, all lead	103.84

Shipments for the week: Blende, 15,222; lead, 1,588 tons. Value, all ores the week, $894,960.

Buyers encountered an easy purchasing market this week, and a total of 18,010 tons was bought, filling all requirements at an early hour today. Production advanced to 16,190 tons. Sellers have apparently decided to produce and sell freely as long as the market continues strong on a $50 basis for Prime Western grades.

Lead was advanced $2.50 per ton, with buyers obtaining a scant tonnage.

Platteville, Wis., July 24, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$52.75
Lead Ore	
Lead, basis 80 per cent lead	$107.50

Shipments for the week: Blende, 1,280 tons; lead, none. Shipments for the year: Blende, 30,219; lead, 752 tons. Shipments for the week to separating plants, 2,254 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the July 3 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3½c. per lb. Slightly more interest. London, £14 per long ton.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and Zinc Oxide are unchanged from prices in the July 3 issue.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $88@$90 per gross ton, furnace; prompt and future.

Ferrosilicon — Per gross ton, f.o.b. works: 50 per cent, $85 delivered in carload lots; 75 per cent, $145; 14-16 per cent, $45.

Ferrotungsten—Per pound contained W. f.o.b. works according to grade, $0.95@$1.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrotitanium, Ferrouranium, Ferrovanadium, and Spiegeleisen are unchanged from prices in the July 3 issue.

Metal Products

Rolled Copper—Per pound, sheets, 22½c.; wire, base price, 16c.

Lead Sheets—Rolled, 12½c.; clipped, 12¾c.

Nickel Silver—29¾c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal — Dimension sheets, 20½c. per lb.; rods, 17½c. per lb.

Zinc Sheets—Per pound, f.o.b. works, 11¾c.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and Zirkite are unchanged from prices in the July 3 issue.

Steel and Coke Firm— Pig Iron Quiet

Pittsburgh, July 27, 1926

The steel market shows no developments of material consequence.

Ingot production thus far this month has averaged nearly if not quite 80 per cent of capacity, and thus there will be little if any decrease from June production, when a July dip is ordinarily expected. On the other hand, there is no definite reason for expecting any upturn later in the year, as occurred after the summer dips of last year and the year before.

Pig Iron—Bessemer is easier, at $18.50@$19, Valley, against $19 previously quoted, basic remaining at $17.50, Valley, and foundry at $17.75.

Connellsville Coke—Spot furnace $2.85@$3; spot foundry, $4@$4.50.

Company Reports

McIntyre Porcupine Earnings Show Steady Increase

The financial statement of the McIntyre Porcupine Mines, Ltd., for the year ended June 30, 1926, is set forth hereunder. The company mines gold ore in the Porcupine district in Ontario.

	Third Quarter March 31, 1926	Fourth Quarter, June 30, 1926	Fiscal Year to Date	Total Last Fiscal Year to Date
Gross recovery	$972,399.79	$999,568.50	$3,804,774.90	$3,546,637.52
Costs, including development	537,812.20	525,538.36	2,121,322.54	1,927,500.15
Operating earnings	$434,587.59	$474,030.14	$1,683,452.36	$1,619,137.37
Non-operating revenue	27,853.98	27,577.13	104,444.15	95,833.13
	$462,441.57	$501,607.27	$1,787,896.51	$1,714,970.50
Less: Provision for taxes for period	18,604.68	14,267.62	66,514.00	96,064.31
Net earnings before plant depreciation	$443,836.89	$487,339.65	$1,721,382.51	$1,618,886.19

American Z., L. & S. Earns $112,843

The American Zinc, Lead & Smelting Co. reports for the quarter ended June 30, 1926, an operating profit of $112,843 before depreciation and depletion, compared with $118,008 in the preceding quarter and $86,230 in the second quarter of 1925. Operating profit before depreciation and depletion for the first six months of 1926 totaled $230,851, against $300,528 in the first six months of 1925.

Magma Copper Earns Less

The Magma Copper Co. reports for the quarter ended June 30, 1926, net earnings of $420,871 before depreciation and federal taxes, comparing with $422,836 before depreciation in the preceding quarter.

Transvaal Gold Output

The total output of gold of the mines of the Transvaal for April, 1926, amounted to 803,303 oz., compared with 834,340 oz. in March and 787,519 oz. in April, 1925. The following table shows the monthly output for the last five years:

	1922	1923	1924	1925	1926
			Fine Ounces		
January	639,728	764,469	796,768	823,692	796,270
February		704,970	760,617	753,925	753,924
March		761,586	795,671	825,479	834,340
April	511,338	743,651	768,923	787,519	803,303
Four months	1,151,066	2,974,676	3,131,979	3,190,615	3,187,837
May	629,786	786,564	809,003	813,249	849,214
June	675,697	755,309	773,053	780,251	.....
July	730,635	754,306	829,437	818,202	.....
August	752,490	769,371	809,571	808,218	.....
September	747,089	739,504	799,422	797,247	.....
October	778,159	793,842	827,583	812,832	.....
November	764,476	780,639	802,313	787,633	.....
December	790,712	778,849	825,273	791,455	.....
Totals	7,020,110	9,133,060	9,597,634	9,599,702	4,037,051

Far East Absorbs American Silver

The Far East continues to absorb silver on a large scale, taking a much larger proportion of the exports from the United States. For the eleven months of the federal fiscal year ended with May, silver exports to British India and China totaled $79,408,732, compared with $70,088,207 in the corresponding period of the preceding fiscal year, an increase of $9,320,525.

Exports to India and China of $79,408,732 constituted 88 per cent of nation's total exports, which amounted to $90,003,806, and exports of $70,088,207 in first eleven months of the preceding fiscal year constituted 70 per cent of the $100,306,235 total exports in that period. Exports to China in the eleven months ended with May amounted to $39,568,844, against $20,347,064, or almost double; and exports to British India were $39,839,888, against $49,741,143. Exports to British India in May were $2,204,882, against $3,241,578 last year, and to China $4,340,894 against $2,342,239.

Dome Mines Not So Profitable as Last Year

The report of the Dome Mines, Ltd., operating gold mines in the Porcupine district of northern Ontario, shows that income in the first half of the calendar year 1926 was considerably less than for the corresponding period last year, though the income in the second quarter was slightly above that of the first three months of 1926, being $442,865 and $429,212 respectively, compared with $500,828 in the second quarter of 1925.

The income account for the six months ended June 30 in each of the last three years compares as follows, the total income reported being that before allowance is made for depreciation and depletion:

	1926	1925	1924
Gross	$1,990,472	$2,136,966	$2,126,768
Expenses	1,163,284	1,116,157	1,130,004
Federal taxes	44,603	63,864	56,311
Balance	$782,585	$956,945	$940,453
Other income	89,492	88,549	113,368
Total income	$872,077	$1,045,494	$1,053,821

Keeley Increases Surplus

The Keeley Silver Mines, Ltd., operating in the South Lorrain district in Ontario, produced during the year ended Feb. 28, 1926, fine silver amounting to 1,514,407.48 oz., the gross value (including cobalt and income from all sources) being $1,144,374.64. The average price of silver, per fine ounce, was 68.940c. (Canadian currency) as against 69.723c. in the previous year. The amount of cobalt produced during the year was 181,054 lb., the price received therefor being the same as in the previous year.

The cost of production, per fine ounce, including all expenses other than a capital expenditure of $5,924.79, was 30.44c. or, including the capital expenditure, 30.83c. per ounce. The net surplus as at Feb. 28, 1926, was $708,516.83, an increase of $102,257.45 over the corresponding figures for the previous year.

The total ore reserves opened up in the mine as at Feb. 28, 1926, are estimated at approximately 25,000 tons, containing about 1,500,000 oz. of silver and 120,000 lb. of cobalt. Immediately prior to the date mentioned (as well as subsequent thereto) there were important discoveries of new ore, but their development had not progressed sufficiently far to permit of their inclusion in the above estimate.

Operating Account for Year Ended Feb. 28, 1926

Expenditure

Development	$137,900.81	
Mining, including hoisting	77,687.12	
Ore sorting	4,778.63	
Milling	44,868.56	
Administration, camp maintenance and general expenses at mine	69,777.70	
Shipping and marketing	71,312.68	$406,325.50
Toronto office expenses	$13,925.98	
Transfer charges and dividend expense	10,733.13	
Legal and directors fees and expenses	11,693.00	36,352.11
Reserved for dominion income and provincial production taxes		56,780.18
Profit for year		644,916.85
		$1,144,374.64

Revenue

Silver and cobalt recoveries, including estimated recovery from ore and concentrates shipped or ready for shipment to smelter		$1,098,665.20
Bond and bank interest earned	$45,069.92	
Miscellaneous earnings and recoveries	639.52	45,709.44
		$1,144,374.64

Cost of Production

(Based on 23,508 tons of ore treated, producing 1,514,407 oz. of silver)

	Total Cost	Per Ton	Per Ounce
Development	$137,900.81	$5.87	$0.091
Ore extraction	77,637.79	3.30	.051
Ore sorting	4,778.63	.20	.003
Milling	44,913.24	1.91	.030
Shipping and marketing	71,312.68	3.03	.047
General maintenance	34,920.52	1.49	.023
Administration at the mine	35,639.62	1.52	.024
Head office expense	9,493.25	.40	.006
Corporate expense	26,081.07	1.11	.017
Taxes	18,289.55	.78	.012
	$460,967.16	$19.61	$0.304

Production of Secondary Metals Increased in 1925

The recovery of sundry metals from secondary sources in 1925 is reported to the U. S. Bureau of Mines as valued at $243,570,700, which is $42,992,100 more than in 1924. The increase in the value of all metals, according to J. P. Dunlop, who compiled the figures, was due both to larger quantities of several kinds recovered and to higher average prices of all the metals in 1925. Although the statistics indicated a decline in brass, this is more apparent than actual, owing to a better classification of alloys, which increased the quantity of bronze and other alloys containing copper.

Summary Showing Secondary Metals Recovered in the United States in 1924 and 1925

	1924		1925	
	Short Tons	Value	Short Tons	Value
Copper, including that in alloys other than brass	196,500	$51,483,000	250,600	$71,170,400
Brass scrap remelted	274,000	58,444,200	242,300	56,270,800
Lead as metal	90,400	32,720,000	112,420	39,477,100
Lead as alloys	114,100		114,460	
Zinc as metal	58,886	9,020,000	61,430	11,359,000
Zinc in alloys other than in brass and in chemical compounds	10,500		13,300	
Tin as metal	7,700	31,062,100	7,950	35,165,400
Tin in alloys and chemical compounds	23,600		23,000	
Antimony as metal	90	2,025,600	1	3,794,000
Antimony in alloys	9,314		10,839	
Aluminum as metal	10,350	14,596,200	17,700	24,816,000
Aluminum in alloys	16,650		26,300	
Nickel as metal[1]	114	1,227,500	191	1,518,000
Nickel in nonferrous alloys and salts	2,126		2,109	
Totals	.....	200,578,600	.....	243,570,700

The following table shows details with respect to the major metals:

Copper

	Short Tons
Copper as metal	183,700
Copper in alloys other than brass	66,900
	250,600
Copper from new scrap (not including brass)	50,000
Copper from old scrap (not including brass)	200,600
	250,600
Brass scrap remelted	
New clean scrap	110,000
Old scrap	132,300
	242,300
Copper content of brass scrap	
New clean scrap	79,200
Old scrap	90,410
	169,610
Total secondary copper (including copper content of brass scrap)	
From new scrap	129,200
From old scrap	291,010
	420,210

Lead

	Short Tons
Secondary lead recovered by smelters that treat mainly ore	35,146
Secondary lead recovered by smelters that treat only scrap and drosses	77,274
	112,420
Secondary lead recovered in remelted alloys	
Lead content of antimonial lead scrap treated at regular lead smelters	9,483
Lead content of drosses and scrap alloys treated at secondary smelters	104,977
	114,460
Total secondary lead recovered	226,880

Zinc

	Short Tons
Secondary zinc recovered by redistillation	39,181
Secondary zinc recovered by sweating and remelting	22,249
Total zinc recovered unalloyed	61,430
Zinc recovered in alloys other than brass	13,300
Zinc recovered in brass (estimated)	53,300
Zinc dust made from zinc dross	5,813
Zinc dross used for zinc dust (estimated)	6,850
Lithopone made from zinc skimmings and ashes	48,705
Secondary zinc content of lithopone	9,741
Zinc chloride made from zinc skimmings and ashes	45,772
Zinc content of zinc chloride made from skimmings and ashes	10,070
Zinc content of zinc sulphate made from zinc drosses and skimmings	858
Zinc concentrates and ore exported	68,951
Zinc dross exported	15,968

Mining Dividends Greatly Increased in July

The following dividends were paid in July by mining and metallurgical companies operating in the Americas:

Companies in the United States	Situation	Per Share	Total
Aluminum Co. of America, pfd	Various	$1.50 Q	$2,208,625
Arizona Commercial, c	Ariz.	0.50 SA	132,500
Cleveland-Cliffs Iron	Mich.	1.00 Q	400,000
Consolidated Lead & Zinc "A"	Kans.	0.625Q	109,375
Cresson Consolidated Gold	Colo.	0.10 Q	122,000
Eagle-Picher Lead, pfd., l, z	Okla., Mo.	1.50 Q	12,829
Gladstone Mountain, l	Wash.	0.01 M	13,219
Homestake Mining, g	S. D.	0.50 M	125,580
Inland Steel, pfd	Minn.	1.75 Q	175,000
Inspiration Consolidated Copper	Ariz.	0.50 Q	590,983
Kennecott Copper	Alaska	1.00 Q	4,474,281
Magma Copper, c, s	Ariz.	0.75 Q	306,116
New Jersey Zinc	Various	2.00 X	981,632
Newmont Mining, h	Various	0.60 Q	258,000
Nichols Copper, pfd	N. Y.	1.75 Q	40,434
Park-Utah Consolidated, s, l, z	Utah	0.15 Q	314,025
Phelps Dodge, c	Various	1.50 Q	750,000
Plutus Mining, s, l	Utah	0.15 I	150,000
Portland Gold	Colo.	0.02 Q	60,000
Republic Iron & Steel, pfd	Various	1.75 Q	437,500
Silver King Coalition, s, l	Utah	0.25 Q	304,025
Sloss-Sheffield Steel & Iron, pfd	Ala.	1.75 Q	117,250
Tomboy Gold, g, s, l	Colo.	ls.	£15,500
U. S. Smelting, Ref. & Mng., s, l	Various	$0.875Q	$307,225
U. S. Smelting, Ref. & Mng., pfd	Various	0.875Q	425,556
Utah-Apex, l, c, s, g	Utah	0.25 Q	132,050
Virginia Iron, Coal & Coke, pfd	Va.	2.50 SA	125,000
Companies in other countries			
Ahumada Lead, l, s	Chihuahua	0.25 Q	298,004
Asbestos Corporation, pfd	Quebec	1.75 SA	70,000
Consolidated Mining & Smelting, l, z, c	B. C.	3.75 SAY	1,906,335
Dome, g	Ont.	0.50 Q	500,000
Erupcion, l, s	Chihuahua	0.10 Q	125,000
Frontino & Bolivia Gold	Colombia	6d.	£3,500
Hollinger Consolidated Gold	Ont.	$0.10 4 wks.	$492,000
Howe Sound, c, l, s	B. C., Mex.	0.75 Q	297,622
Lucky Tiger-Combination, g, s	Sonora	0.12 M	85,840
Mining Corporation, s	Ont.	0.125SA	207,506
N. Y. & Honduras Rosario, g, s	Honduras	0.50 Q	100,000
Nipissing, s	Ont.	0.15 Q	180,000
Premier Gold, s, g	B. C.	0.08 Q	400,000
Santa Gertrudis, g, s	Hidalgo	ls.	£75,000
Silversmith, s, l, z	B. C.	$0.02 Q	$50,000
Wright-Hargreaves, g	Ont.	0.075Q	206,250
Total			$17,991,762

c, copper; l, lead; z, zinc; g, gold; s, silver; h, holding company; Q, quarterly, SA, semi-annually; M, monthly; X, extra; I, initial; Y, includes $3 extra.

Mining dividends for July showed a great increase over those paid a year ago, or for the previous corresponding quarters, the total being almost $18,000,000 compared with $11,000,000 in July, 1925, $14,600,000 in January, 1926, and $14,500,000 in April, 1926. This reflects a most encouraging prosperity of the mining companies and one that seems on the increase. New Jersey Zinc paid an extra dividend and Phelps Dodge, among the big companies, increased its dividend from $1 to $1.50. Hollinger began this month to pay 10c. a share every four weeks. Plutus, at Eureka, Utah, paid its first dividend. Portland Gold again paid 2c. a share, the same as three months ago, so is presumably on a regular quarterly basis. Consolidated M. & S. made a liberal distribution, although this company has no regular dividend policy, making semi-annual payments of varying amount; a year ago it paid 75c.; last January, $5.75; and this month, $3.75. Gladstone Mountain increased its rate from ½c. per share to 1c.

Dividend Yields

The dividend yields on the stocks of the above-named companies that are on a regular dividend basis, based on the June distributions except as otherwise noted, and on recent market prices, are as follows:

Company	Per Cent Annual Yield	Company	Per Cent Annual Yield
Gladstone Mountain	41.7	Howe Sound	7.8
Erupcion	28.0	Magma Copper	7.5
Dome	19.8	Republic I. & S., pfd	7.3
Portland Gold	18.2	Kennecott Copper	7.3
Silversmith	17.4	U. S. Smelting, pfd	7.1
N. Y. & Honduras	17.4	Va. I. C. & C., pfd	7.0
Cresson Consolidated	16.8	Hollinger Consolidated	6.6
Premier Gold	15.0	Mining Corporation	6.4
Utah Apex	13.2	Sloss-Sheffield, pfd	6.4
Ahumada	12.5	Inland Steel, pfd	6.3
Silver King Coalition	11.0	Aluminum, pfd	6.0
Homestake	11.0	N. J. Zinc*	5.8
Nipissing	10.9	Cleveland-Cliffs	5.6
Consolidated, Lead & Zinc	10.6	Eagle-Picher, pfd	5.4
Asbestos, pfd	9.5	Phelps Dodge	4.9
Park-Utah	9.4	Consolidated M. & S.*	4.4
U. S. Smelting	8.7	Newmont	3.8
Inspiration Copper	8.2	Wright-Hargreaves	3.5
Arizona Commercial	8.1		
Average			10.7

* Based on total dividends for the last 12 months.

Current Prices of Mining Supplies

Rise and Fall of the Market

THE lumber market continues weak. Price declines, however, are more conspicuous in material for frame building construction than in large dimension stock and mine timbers. Several items on the steel list are firmer, namely, structurals, welded pipe, and railroad spikes. The recent up-swing in linseed oil prices is about checked, while flotation oil quotations are slightly above the level of the last three months. Declines in manila rope are noted in several of the Southern points.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.30@$2.40	$3.60	$3.50	$3.90	$3.89
Black No. 28	3.00@ 3.15	4.60	4.10	4.90	4.50
Galvanized No. 28	4.20@ 4.40	5.70	5.25	6.00	5.65

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅜-in. and larger	$2.90@3.00	$2.80	$3.55	$3.65	$4.35	$3.00
Track bolts	3.90@4.15	3.90@4.00	4.55	4.40	5.85	3.90
Standard section angle bars	2.75	2.75	3.40	3.25@3.75	4.00	4.15

STRUCTURAL MATERIAL—Following are base prices in carload lots, f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. in less than carload lots, from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.90@2.00	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channel, 3 to 15 in.	1.90@2.00	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 6 in., ¼ in. thick	1.90@2.00	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	1.90@2.00	2.10	3.34	4.15	3.35	3.10	3.30
Plates ¼-inch thick	1.90	2.00	3.34	4.15	3.25	3.10	3.30

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	30%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60@65%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

	Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD—	1 to 3	62	50½	1 to 1½	30	12
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	48%	51%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$51.60@53.60	$50.60@51.60	$41.00 @ 42.00 base	$49.20@50.20	$47.50	$50.00

NUTS—Semi-finished, ½x½-in., 2c. each. Discount 70% for ⅜-in. and smaller; 65% for ½-in. and larger. Case hardened, 6c. each, less 50%.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1112	$0.1162	$0.075	$0.12	$0.07	$0.108	.....
6x12x12	.1667	.1743	.096	.....	.094	.156	$0.252*
8x12x12	.2084	.2179	.135	.22	.128	.244	.312†

* 10x12x12; † 12x12x12.

MACHINE BOLTS—½x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%.

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago Up to 20 Ft., Pine	Chicago Up to 32 Ft., Fir
3x4 to 8x8	$43.00	$44.00	$41.50	$40.50
3x10 to 10x10	50.00	51.00	47.50	40 50
3x12 to 12x12	57.00	58.00	57.50	40.50

Other Cities	8 x 8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir*
Boston	$50.00	$48.50†	$50.00	$50.50	$60.00	$58.00†
Cincinnati	37.00	73.00	73.00	85 00	48.00	77.00
Denver	.....	36.25	34.75	34.75	.....	34.75
Minneapolis	41.00	38.25	34.00	.....	43 00	38.75
Kansas City, Mo.	44.50	40 75	.....	.....	59.50	41.75
Philadelphia	54.00	36.00	38.00	45.00	65.00	36.00

*Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.65	$3.05	$3.75	$4.25	$2.93	$4.95
Cut	2.80	....	5.00	5.00	3.15	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.50@2.60	$2.50@2.60	$2.50@2.60
Chicago, f.o.b.	2.10	2.10	2.20
Cleveland, f.o.b.	2.29	2.29	2.39

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	280-lb. net Common
New York	$18.20	$12.10	$3.50	$2.10@$3.00
Chicago	20.00	18.00	....	2.25

LINSEED OIL—These prices are per gallon:

	New York Currant	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.94½	$1.07	$0.95	$1.23

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	15.25	15.75	16.75	17.25
White	15.25	15.75	15.25	15.75

HOSE—Quotations at New York warehouses:

Fire Protection — 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket (net) ..... 74c per ft.

Air—Best Grade
¾-in., per ft. ..... 3 ply $0.37½ 4 ply $0.46

Steam—Discounts from List
First grade ..... 30–10% Second grade ..... 40% Third grade ... 40–10%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting.
Best grade ..... 50% Second grade 50–10%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40–5%
Heavy	30–10%

RAWHIDE LACING
For cut, best grade, 50%, 2nd grade, 60%.
For laces in sides, best, 41c. per sq.ft.; 2nd, 37c.
Semi-tanned: cut, 50%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ½ in.	$1.05
Rubber sheet	.60
Rubber sheet, wire insertion	.85

MANILA ROPE—Per lb., ½-in. and larger, 1,200-ft. coils.

Atlanta	$0.27	New Orleans	$0.23½
New York	.26	Seattle	.24
Chicago	.24½	San Francisco	.25

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.26	$0.2875
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.233	.26
San Francisco	.1625	.1925

FLOTATION OIL—
Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.46

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. works, per lb.	$0.09@.10
Litharge, f.o.b. New York, kegs, per 100 lb.	15.25
Sodium cyanide, 220 lb. single case lots, f.o.b. works, per lb.	18@.22
Calcium carbide, in drums, f.o.b. works, per lb.	.05½@.06

Mining Stocks—Week Ended July 24, 1926

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Anaconda	New York	51	48¼	49	Jy.17, Au.23 Q 0.75
Arcadian Consol.	Boston	1½	1	1	.....
Ariz. Com'l	Boston	12⅜	11¾	12	Jy. 16, Jy. 30 0.50
Calaveras	N. Y. Curb	...	...	1½	.....
Calumet & Arizona	New York	69¼	66½	68	Jn. 4, Jn. 21 Q 1.50
Calumet & Hecla	Boston	15⅞	15⅜	15½	Jn. 1, Jn. 15 Q 0.50
Cerro de Pasco	New York	68½	66⅛	67	Jy. 15, Au. 2, Q 1.00
Chile Copper	New York	34¼	33⅛	33⅜	Jn.2,Jn.28, Q 0.62½
Chino	New York	24	22⅞	22¼	Sept., 1920 0.37½
Con. Coppermines	N. Y. Curb	3¼	3¼	3⅜	.....
Copper Range	Boston	17⅛	16½	16⅝	May, 1925 1.00
Crystal Copper	Boston Curb	*36	*30	*30	.....
East Butte	Boston	3⅜	3⅛	3½	Dec., 1919 0.50
First National	Boston Curb	*25	*20	*25	Feb., 1919 0.15
Franklin	Boston	...	...	*60	.....
Granby Consol	New York	23⅜	22½	22½	May, 1919 1.25
Greene-Cananea	New York	22⅛	17¼	22	Nov., 1920 0.50
Hancock	Boston	1½	1	1	.....
Howe Sound	New York	39⅛	37⅞	37⅞	Ap.1, Ap.15 0.75
Inspiration Consl	New York	25⅝	24⅛	25	Jn.7, Jy.6, Q 0.50
Iron Cap	Boston Curb	4⅛	3⅜	4¼	Jn. 1, Jn. 15 0.50
Isle Royale	Boston	13½	12	12	Jn. 1, Jn. 15 0.50
Jerome Verde Dev	N. Y. Curb	*65	*58	*58	.....
Kennecott	New York	56¾	55	56½	Jn. 4, July 1 Q 1.00
Lake Copper	Boston	...	...	1½	June, 1925 0.50
Magma Copper	New York	42¼	39⅜	39⅝	Jn.30,July.15,Q 0.75
Mason Valley	N. Y. Curb	...	...	1½	.....
Mass Consolidated	Boston	*75	*75	*75	Nov., 1917 1.00
Miami Copper	New York	15⅝	14½	14½	Aug.2, Aug.16 Q 0.25
Mohawk	Boston	39	37½	38	Jy.31, Se.1 Q 1.00
Mother Lode Coa	New York	6⅜	5½	6½	Jn. 15, Jn. 30 0.37½
Nevada Consol	New York	14½	13⅜	13⅞	Jn. 15, Jn. 30 Q 0.25
New Cornelia	Boston	23½	22	22	Au.6, Au.23 Q 0.04
North Butte	Boston	2⅞	2½	2½	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	*62	*60	*60	No. 14, De. 2 0.05
Old Dominion	Boston	20	18⅛	18⅛	Dec., 1918 1.00
Phelps Dodge	Open Mar.	†125	†120	...	Jun.22, July2 Q 1.50
Quincy	Boston	24⅛	21⅞	21⅛	Mar., 1926 1.00
Ray Consolidated	New York	14⅜	13⅛	13⅛	Ap.20, Ap.30 0.25
Ray Hercules	N. Y. Curb	...	...	11⅞	.....
St. Mary's Min. Ld	Boston	32½	30½	30½	Ap.17, My.18 2.00
Seneca Copper	New York	7⅛	6½	6½	.....
Shannon	Boston	*65	*40	*40	Nov., 1917 0.25
Superior & Boston	Boston	*90	*75	*75	.....
Tenn. C. & C.	New York	12⅝	11⅞	11⅞	My. 29 Ju.15,Q 0.25
United Verde Ex	N. Y. Curb	29½	28½	29	Jy.17, Aug. 2, 0.75
Utah Copper	New York	103	102	103	Jn.15,Jn.31,Q 1.25
Utah Metal & T	Boston	1 1/16	1⅛	1⅛	Dec., 1917 0.30
Victoria	Boston	...	...	*50	.....
Walker Mining	Salt Lake	*55	*51	*53	.....
NICKEL-COPPER					
Internat. Nickel	New York	39⅛	37	37⅛	Je.17, Je.30, 0.50
Internat. Nickel, pfd.	New York	....	....	104	Jy.12, Au.2, 1.50
LEAD					
Gladstone M. M. Co.	Spokane	*30	*27	*30	Jn. 10, Jy.10 0.01
National Lead	New York	162½	154	155½	Jn. 11, Jn. 30 Q 2.00
National Lead pfd	New York	....	....	116¼	My.21, Je.15 Q 1.75
St. Joseph Lead	New York	43½	41½	42	Jn.10, Jn.21 QX 0.75
ZINC					
Am. Z. L. & S	New York	9	7⅛	7⅛	May., 1920 1.00
Am. Z. L. & S, pfd	New York	39⅛	34	34	Nov., 1920 1.50
Butte C. & Z	New York	5⅜	5	5¼	De.10, De.24 0.50
Butte & Superior	New York	11½	10⅛	10⅛	Jn.15, Jn.30 Q 0.50
Callahan Zn-Ld	New York	1⅜	1⅛	1⅛	Dec., 1920 0.50
Eagle Picher	Cincinnati	31½	30⅛	31	My. 15, Jn.1 0.40
Eagle Picher, pfd	Cincinnati	....	....	110	Jn.30, Jy.15 Q 1.50
New Jersey Zn	N. Y. Curb	....	....	208	Jn.9, Jy.10 Q 2.00
United Zinc	N. Y. Curb	....	....	*70	.....
Yellow Pine	Los Angeles	....	....	*25	De.8, De.18 Q 0.04
GOLD					
Alaska Juneau	New York	1⅛	1⅛	1⅛	.....
Argonaut	Toronto	*19½	*19	*19½	.....
Barry-Hollinger	Toronto	*47	*46	*47	.....
Carson Hill	Boston	*26	*22	*22	.....
Consol. W. Dome L.	Toronto	*15¼	*14⅛	*14¼	.....
Cresson Consol. G	N. Y. Curb	2⅛	2⅛	2 1/16	Mh.31, Ap.10 0.10
Crown Reserve	Toronto	*10¼	*10	*10	Jan., 1917 0.05
Dome Mines	New York	11	10⅛	10⅜	Jn.30,July 20,Q 0.50
Golden Center	N. Y. Curb	1⅜	1⅛	1⅜	.....
Golden Cycle	Colo. Springs	1.52	1.51½	1.52	No.30,Dec.10 Q 0.03
Hollinger Consol.	Toronto	19.75	19.65	19.65	Jy.27, Au.12 M 0.10
Homestake Mining	New York	55	54	54	Jy.20, Jy.26 M 0.50
Kirkland Lake	Toronto	1.02	*98	*99	.....
Lake Shore	Toronto	12.50	11.50	12.25	Jn.1, Jn. 15 Q 0.10
McIntyre-Porcupine	New York	25¼	25⅛	25⅛	Au.2, Se.1 Q 0.25
Newray	Toronto	*33	*33	*33	.....
Noranda	N. Y. Curb	17⅛	15⅞	16⅝	.....
Portland	Colo. Springs	*44	*43½	*43½	July6, July15 0.02
Rand Mines	New York	34½	34¼	34½	Fe.16, Fe.26 1.52
Teck-Hughes	Toronto	3.94	3.83	3.84	Jy. 15, Au. 2 0.05
Tom Reed	Los Angeles	*60	*60	*60	Ma.10Ma.20 0.02
Tough-Oakes	Toronto	*39	*38	*39	.....
United Eastern	N. Y. Curb	...	...	*30	July, 1924 0.05
Vipond Cons	Toronto	1.81	1.74	1.76	.....
Wright-Hargreaves	Toronto	8.50	8.45	8.48	Jn.15, Jy.1 Q X 0.07½
Yukon-Alaska Trust	N. Y. Curb	....	....	21	.....
GOLD AND SILVER					
Carnegie Metals	Boston	14½	14	14	.....
Con. Cortez	N. Y. Curb	*5	*5	*5	.....
Con. Virginia	San Francisco	*6½	*6½	*6½	.....
Continental Mines	N. Y. Curb	....	....	*45	.....
Dolores Esperanza	N. Y. Curb	....	....	*40	July, 1923 0.05
Premier Gold	N. Y. Curb	2½	2½	2½	Jn.18, Jy.3 Q 0.08
Tonopah Belmont	N. Y. Curb	3⅛	3	3⅛	Se.15, Oc.1 0.05
Tonopah Extension	N. Y. Curb	*50	*50	*50	Apr. 1925 0.05
Tonopah Mining	N. Y. Curb	...	...	6½	Ap.7, Ap.21 Q 0.07½
Unity Gold	N. Y. Curb	...	...	*30	.....
West End Consol	N. Y. Curb	*15	*15	*15	Mar., 1923 0.05
Yukon Gold	N. Y. Curb	...	...	*30	June, 1918 0.02

Stock	Exch.	High	Low	Last	Last Div.
SILVER					
Alvarado	N. Y. Curb	....	....	1	Oct., 1920 0.50
Beaver Consol	Toronto	*81	*80	*80	May. 1920 0.03
Castle-Trethewey	Toronto	1.56	1.49	1.52	.....
Coniagas	Toronto	3.80	3.80	3.80	May, 1924 0.12½
Keeley	Toronto	1.74	1.65	1.66	Ma. 1,Ma.15 X 0.12
Kerr Lake	N. Y. Curb	....	....	1	Ap. 1, Ap.15 0.12½
La Rose	Toronto	*11½	*10	*10	Apr., 1922 0.10½
Lorrain Trout Lake	Toronto	...	...	*85	Jy. 2, Jy. 15 0.05
McKinley-Dar.-Sav	Toronto	*13	*13	*13	Oct., 1920 0.03
Mining Corp. Can	Toronto	4.07	3.66	3.95	Jy.1, Jy.15 0.12½
Nipissing	N. Y. Curb	5⅛	5¼	5⅜	Jn.30, Jy.20 0.15
Temiskaming	Toronto	...	...	*11	Jan., 1920 0.40
SILVER-LEAD					
Ahumada	New York	8⅛	8⅛	8⅛	Jn.18,Jy.5, Q X 0.25
Alta Merger	Salt Lake	†*5½	†*2½	....	.....
Bingham Mines	Boston	33	33	33	Jn.19,Jn.30 Q 1.00
Cardiff M. & M	Salt Lake	*51	*50	*50	De.16, No.18 0.10
Chief Consol	Salt Lake	3.40	3.40	3.40	Jy.10, Au.10 Q 0.10
Emma Silver	Salt Lake	†1	†*50	....	.....
Erupcion	Boston Curb	1⅞	1⅜	1⅜	Jn.18, Jy.5,QX 0.10
Federal M. & S	New York	75	75	75	.....
Federal M. & S., pfd.	New York	72	72	72	My.25, Ju.15 Q 1.75
Hawthorne Mines	N. Y. Curb	*17	*14	*15	.....
Hecla Mining	N. Y. Curb	18⅛	18	18⅛	My.15, Je.15 Q 0.50
Iron King Mining	Salt Lake	†*27	†*24	....	.....
Keystone Mining	Salt Lake	†*30	†*26	....	Au.12, Au.26 0.07½
Lucky Jim	Spokane	*17½	*15½	*15½	.....
Mammoth Mining	Salt Lake	2.75	2.75	2.75	Mar.24,Apr. 1 0.10
Marsh Mines	Spokane	2⅜	2⅛	2⅛	Se.15, Oc.1 0.15
Park Utah	New York	6.80	6.70	6.75	Jn.15, Jy.1 Q 0.15
Prince Cons	Salt Lake	1⅜	1	1	.....
Silver King Coal	Salt Lake	9.05	9.05	9.05	Jn. 21, July1, Q 0.25
Silversmith	Spokane	*46	*44½	*45½	Jn.30, Jy.10 Q 0.02
Tamarack-Custer	Spokane	*30½	*28	*28	Sept., 1924 0.25
Tintic Standard	Salt Lake	12.37½	12.37½	12.37½	Jn.16, Jn.26, 0.40
Utah-Apex	Boston	8	7⅞	7 1/16	Jy. 3, Jy.15 Q 0.25
Western Utah Copper	N. Y. Curb	...	...	*8	.....
IRON					
Bethlehem Steel	New York	47	44½	45½	July, 1924 1.25
Colorado Fuel & Iron	New York	47⅛	44⅛	45⅜	May, 1921 0.75
Gt. North'n Iron Ore	New York	21	19⅜	19⅛	De. 4, De. 28, 0.75
Inland Steel	New York	42	41	41	My.10, Je.1 Q 0.75
Mesabi Iron	N. Y. Curb	1⅜	1⅛	1⅛	.....
Replogle Steel	New York	10⅛	9⅛	10⅛	.....
Republic I. & S.	New York	60⅛	54⅜	57⅛	Au.14, Se.1 1.00
Republic I. & S. pfd.	New York	96⅜	96	96	Se.15, Oc.1 Q 1.75
Sloss-Sheffield S. & I.	New York	131	121½	122	Jn.10, Jn.21 Q 1.50
Sloss-Shef. S.&I. pfd.	New York	...	...	110	Jn.21, July.1, Q 1.75
U. S. Steel	New York	144⅛	137⅛	137⅛	Jn.2, Jn.29 Q 1.75
U. S. Steel pfd	New York	129⅛	128⅛	129⅛	My.4, My.29,Q 1.75
Virginia I. C. & C.	New York	45	43	43	Jan., 1924 1.50
Virginia I.C.&C.pfd	New York	70½	70	70	Jn.1, July 2, 2.50
ALUMINUM					
Alum.Co.of Amer	N.Y.Curb	Ind. 70⅛	70½	70⅛	.....
Alum. Co. of Amer pf.	N.Y.Curb	Ind.	....	99⅛	June 15, July 1, Q 1.50
VANADIUM					
Vanadium Corp.	New York	36⅛	35⅛	35⅞	Au.2, Au.16, Q 0.75
ASBESTOS					
Asbestos Corp., New	Montreal	18	18	18	De.31, Ja.15 Q 1.50
Asbestos Corp., pfd.	Montreal	72	71	71	Jy.1, Jy.15, Q 1.75
SULPHUR					
Freeport Texas	New York	33½	30⅛	30⅛	Nov., 1919 1.00
Texas Gulf	New York	161½	154½	156½	Jn.1, Jn. 15, Q 2.50
DIAMONDS					
De Beers Consol	New York	....	....	35½	Ju.16, Ju.17 1.70
PLATINUM					
So. Am. Gold & P	N. Y. Curb	5⅛	4⅞	5⅛	.....
MINING, SMELTING, REFINING AND GENERAL					
Amer. Metal	New York	54	52½	52½	My.20, Je. 1, Q 1.00
Amer. Metal pfd	New York	...	...	117	My.20, Je. 1 Q 1.75
Amer. Sm. & Ref.	New York	136⅛	128⅛	128⅛	Jy.10, Au.2, Q 1.75
Amer. Sm.&Ref.pfd.	New York	119½	118½	119½	Au.7, Se.1, Q 1.75
Consol. M. & S.	N. Y. Curb	....	....	208	Jn.30, Jy.5 QX 3.75
Federated Metals	N. Y. Curb	....	....	12⅛	.....
Newmont Mining	N. Y. Curb	64⅛	62	63½	Mar.31,Apr.15, 0.60
Southwest Metals	N. Y. Curb	....	....	1	Jn.30, Jy.15 0.60
U. S. Sm. R. & M.	New York	42	40½	40½	Jy. 7, Jy. 15, Q 0.87½
U. S. Sm. R.&M.pfd.	New York	49	49	49	Jy. 7, Jy. 15, Q 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED JULY 14, 1926

Name	High	Low	Last	Last Divd. Date	Amount
Aramayo Mines (25 frs.)	82/3	78/9	80/—	May. 1926	5 p.c.†
British Platinum (£1)	6/—	5/—	5/6	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	15/9	15/3	15/6	Aug. 1926	7 annas*
Bwana M'Kubwa (5s)	8/1½	7/9	7/9		
Camp Bird (£1)	4/9	4/6	4/9		
El Oro (£1)	9/1½	6/6	8/10½	Nov. 1924	2½ p.c.*
Esperanza (10s)	1/1½	1/—	1/—		
Frontino & Bolivia (£1)	7/7½	6/3	6/3	July 1926	2½ p.c.
Mexican Corpn. (£1)	16/6	15/6	16/3	Dec. 1925	12½ p.c.*
Mexico Mines of El Oro (£1)	31/—	27/6	28/9	June 1926	7½ p.c.*
Oroville Dredging (£1)	3/10½	3/9	3/9	Dec. 1923	3¾ p.c.
Ouro Preto (£1)	2/1½	2/—	2/—	May 1925	2½ p.c.
Rhodesian Congo Border	122/6	117/6	122/6		
St. John del Rey (£1)	9/3	8/9	9/3	June 1925	6¼ p.c.
San Francisco Mines (10s)	30/6	28/—	29/9	June 1926	15 p.c.
Santa Gertrudis (£1)	20/—	18/6	19/—	July 1926	5 p.c.
Selukwe (2s. 6d.)	13/6	12/1½	13/1½	April 1917	6⅔ p.c.
S. Amer. Copper (2s.)	4/6	4/3	4/3	Nov. 1917	75 p.c.
Tanganyika (£1)	40/6	37/3	38/1½	Sept. 1925	5 p.c.
Tomboy (£1)	4/—	3/9	4/—	July 1926	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	11.000	8.600	10.000	July 1926	178 frs.‡

* Free of British income tax. † Swiss frs. ‡ Belgian frs.